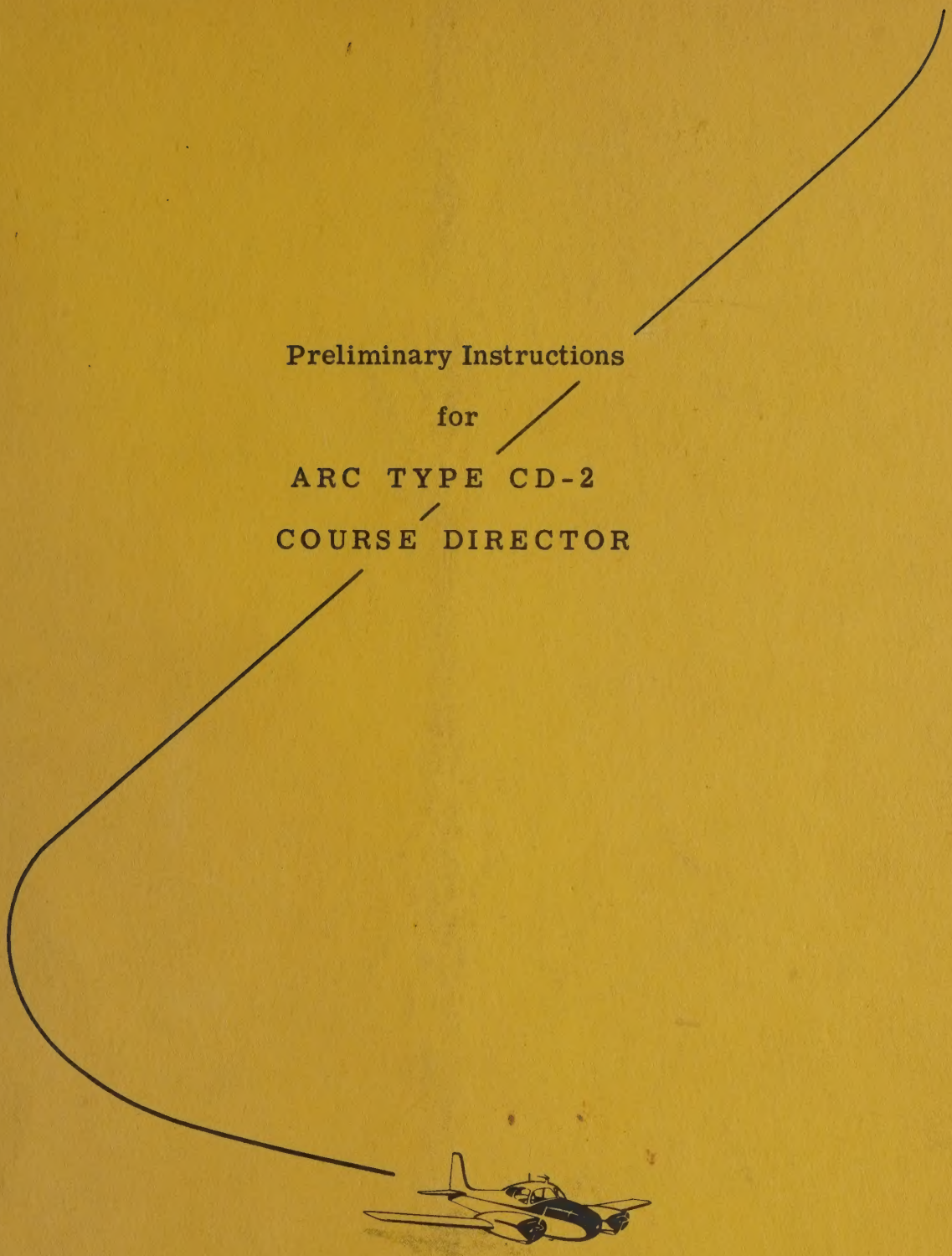
Preliminary Instructions

for

ARC TYPE CD-2

COURSE DIRECTOR



Aircraft Radio Corporation

Boonton, New Jersey

Preliminary Instructions

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ARC TYPE CD-2

COURSE DIRECTOR

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WARRANTY

Aircraft Radio Corporation (ARC) warrants each item of new equipment manufactured by it to be free from defects in material and workmanship under normal service use for which intended. ARC obligates itself under this warranty to replace or repair (at ARC discretion), at its factory, any ARC equipment, or major unit thereof (excluding vacuum tubes and transistors), which shall within one year after delivery to the original purchaser thereof be returned, transportation charges prepaid, to ARC with a statement from an authorized ARC Distributor or Dealer establishing the date of such delivery, which ARC examination shall disclose to have been defective in manufacture. This warranty shall not apply to any equipment, or major unit thereof, which, in the judgment of ARC, has been repaired or altered in any way so as adversely to affect its performance or reliability, or which has been subject to misuse, negligence or accident. This warranty is in lieu of all other guaranties or warranties express or implied. The obligation and responsibility of ARC for or with respect to defective equipment shall be limited to that expressly provided herein and ARC shall not be liable for consequential or other damage or expense whatsoever therefor or by reason thereof.

ARC reserves the right to make changes in design or additions to or improvements in its equipment without obligation to install such additions or improvements in equipment theretofore manufactured.

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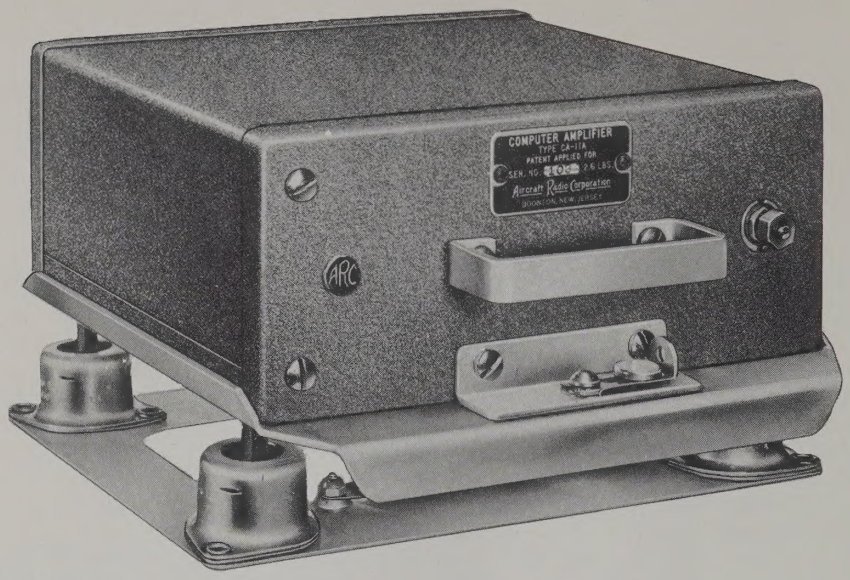
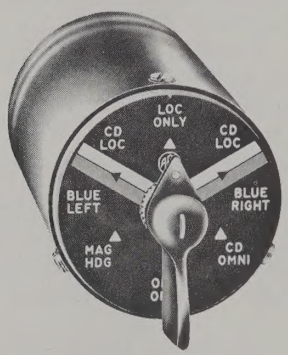
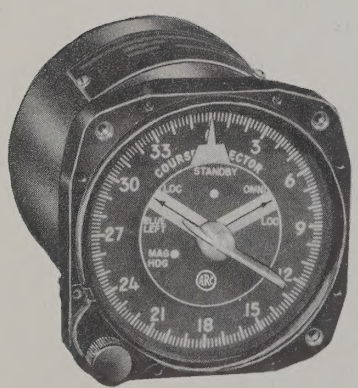


ARC TYPE CA-IIA COMPUTER-AMPLIFIER
WITH ARC TYPE M-40A MOUNTING



ARC TYPE C-60
CONTROL UNIT



ARC TYPE S-10
DIRECTOR CONTROL

ARC TYPE IN-14
COURSE INDICATOR

TP1150

Figure 1-1. ARC Type CD-2 Course Director, Major Units

SECTION I

GENERAL INFORMATION

1-1. PURPOSE.

The ARC Type CD-2 Course Director is an airborne steering-data computer system. When used with a stabilized heading source, and with VOR and localizer receiving equipment, the Type CD-2 provides accurate steering data for en route tracking on VOR and for precise ILS approaches. When used with a stabilized source of heading information only, the Type CD-2 provides a convenient indication of any deviation from the desired heading.

1-2. UNITS AND ACCESSORIES SUPPLIED.

The ARC Type CD-2 Course Director includes the units and accessories listed in Table 1-1. The major units are shown in Figure 1-1.

Note

The CA-11A Computer Amplifier can be used with an ID-249( )/ARN, ID-351A/ARN, or ID-357/ARN Course Indicator in place of an ARC Type IN-14 Course Indicator.

TABLE 1-1. UNITS AND ACCESSORIES

Qty	Name	ARC Type No.	ARC Part No.
	UNITS		
1	Computer Amplifier	CA-11A	21800
1	Control Unit	C-60[1]	18330
1	Course Indicator	IN-14[1]	18028
1	Director Control	S-10[1]	20200
1	Mounting	M-40A	21756
	ACCESSORIES		
1	Switch and Cable Assembly, Monitor	—	20045
1	Connector	—	14320[2]
1	Connector	—	14843[2]
1	Connector	—	16115[2]
1	Connector Assembly Kit SH, consisting of:	—	22446
1	Connector, Plug	—	21766
1	Hood	—	21767
4	Screw, SEMS, Fillister head, 4-40 by 5/32 inch long	—	524(5/32)

[1]The C-60 and IN-14 may be supplied instead of the S-10. In such instances, the IN-14 also functions as part of the ARC Type 15C, or later, VOR equipment. The C-60 may be supplied alone for use with other VOR equipment.
[2]Connector ARC-14843 is supplied for use with the S-10, or Connectors ARC-14320 and ARC-16115 are supplied for use with the IN-14 and C-60.

1-3. UNITS REQUIRED BUT NOT SUPPLIED.

The ARC Type CD-2 Course Director is used with a stabilized heading source, and VOR or localizer equipment. Interconnecting cable assemblies for the Type CD-2 are required but not supplied. These cable assemblies are fabricated from individual wires (not supplied) and the connectors listed in Table 1-1. The recommended wire

sizes and the required connectors are identified in Figures 2-6, 2-7, and 2-8. The connectors used will vary with the units installed. The wire lengths will depend on the location of the equipment in the aircraft. If neither an ARC Type IN-14 Course Indicator nor an ARC Type IN-10 Course Indicator is included, a cross-pointer meter, similar to ARC-13310, is required.

1-4. DESCRIPTION OF UNITS.

Computer Amplifier. The ARC Type CA-11A Computer Amplifier develops a d-c voltage related to the difference between the aircraft's heading and the desired heading or flight path set into the S-10 or IN-14. The developed d-c voltage, of proper magnitude and polarity, is combined with a d-c voltage obtained from the VOR or localizer equipment to present a visual indication by deflecting the vertical needle of a cross-pointer meter. When flown to center the needle, the aircraft will fly an optimum heading to intercept and maintain the desired course.

Modular construction is used for the CA-11A Computer Amplifier. The chassis, enclosed by an aluminum cover, supports a printed-circuit connector board and three plug-in modules. The components of each module are mounted on a printed-circuit board that is supported by a metal frame. The metal frames, in turn, are supported by the chassis. Jacks on one edge of each modular printed-circuit board make the necessary connections with pin plugs on the printed-circuit connector board. The CA-11A requires an ARC Type M-40A Mounting for proper installation.

Input and output connections to the CA-11A Computer Amplifier are made through a single connector mounted on the rear of the chassis. The CA-11A requires approximately 10 volt-amperes from a 115-volt, 400-cps source of power. Power for the CA-11A must be obtained from the same phase (the "dim" phase) of the same source that excites the transmitter synchro of the stabilized heading source.

Course Indicator.

Note

The ARC Type IN-14 Course Indicator is used with the ARC Type C-60 Control Unit for operation of the Type CD-2 only with ARC Type 15C, or later, VOR equipment.

The ARC Type IN-14 Course Indicator is a combined cross-pointer meter and course selector/to-from instrument. The IN-14 differs from the ARC Type IN-10 Course Indicator in that the IN-14 includes a control transformer which provides heading signals for the Type CD-2 equipment. The IN-14 may be used in place of the ARC Type IN-10 Course Indicator, or equivalent, when the Type CD-2 is used with an ARC Type 15C, or later, VOR equipment. The cross-pointer meter of the IN-14 is a special-type microammeter with two pointers and two flag alarms for indicating the reliability of received signals. The vertical pointer is used with the VOR and localizer equipment, and with the Type CD-2. The vertical pointer is pivoted at the top and moves left or right to supply steering information during course director operation, and track displacement information during VOR-localizer operation. The horizontal pointer, which is pivoted at the left and moves up and down, is used with a glide slope receiver. The course selector dial is graduated in a compass scale of 360 degrees and permits the selection of any desired VOR track by adjustment of the pointer-set knob. Simultaneous heading information is provided to the computer amplifier by this operation.

Control Unit.

Note

The ARC Type C-60 Control Unit is used with the ARC Type IN-14 Course Indicator for operation of the Type CD-2 only with ARC Type 15C, or later, Vor equipment. The C-60 may also be used with course indicators such as the ID-249( )/ARN, ID-351A/ARN, and ID-357/ARN.

The ARC Type C-60 Control Unit includes a six-position rotary switch used to select the operating functions of the Type CD-2 and to set up the associated VOR-localizer equipment for VOR or localizer reception. Positions are also included to select VOR, localizer, or heading information alone. All information is displayed on the cross-pointer meter. The switch positions of the C-60 reverse the polarity of the cross-pointer meter when necessary, to permit "flying toward the needle" at all times. A diode limiter is included to limit the cross-pointer voltage output of the ARC Type 15C, or later, VOR equipment when necessary.

Director Control. The ARC Type S-10 Director Control is a combined function-selector switch and course selector instrument. It consists of a four-position switch, a control transformer, a diode limiter, and a

compass-graduated scale. The four-position switch is used to select the operating functions of the Type CD-2 system. This switch controls connections to the cross-pointer meter and reverses the cross-pointer meter polarity when necessary, so that the pilot may always "fly toward the needle." Provisions for automatic set-up of the associated equipment for VOR or localizer operation are not included in the S-10 Director Control. The control transformer provides heading signals for the CA-11A Computer Amplifier. The diode limiter is provided to limit the cross-pointer voltage output of the VOR or localizer equipment when necessary.

Mounting. The ARC Type M-40A Mounting is a shock-proof, vibration-type mounting used to mount the ARC Type CA-11A Computer Amplifier. The mounting consists of two plates separated by vibration-type shock mounts. Screws are used to attach the mounting to the air frame. Flexible grounding straps connect to the upper and lower plates to insure grounding the CA-11A to the air frame. Two bushings on the rear of the CA-11A engage two studs on the M-40A, and the CA-11A is secured to the M-40A by engaging its snapslide with the grooved stud at the front of the M-40A.

Caution

The grounding straps must not be depended upon for use as a system ground.

Monitor Switch. The ARC-20045 Monitor Switch and Cable Assembly consists of two SPDT miniature snap-action switches wired in parallel, and a three-conductor cable. The monitor switch is used to remove momentarily the course director information from the cross-pointer meter. The aircraft's approximate displacement from the desired track is then indicated by the position of the cross-pointer meter's vertical needle. The cable is used to connect the monitor switch to the S-10 Director Control or the C-60 Control Unit.

SECTION II

INSTALLATION AND ADJUSTMENT

2-1. GENERAL INSTALLATION CONSIDERATIONS.

The location and installation of the ARC Type CD-2 Course Director will be governed by the type of aircraft in which it is installed. Specific installation instructions are described in other paragraphs of this section, but considerations should be given to the following when planning the installation:

Unit dimensions and available installation area. Outline dimensions are shown in Figures 2-1 through 2-5. Compare the installation area under consideration with the dimensions noted on the applicable illustration. The location should be such as to permit accessibility for maintenance and inspection.

Location of S-10, C-60, and IN-14. Either the ARC Type S-10 Director Control, or the ARC Type C-60 Control Unit with the ARC Type IN-14 Course Indicator, is required for a Type CD-2 installation. Normally, the units should be mounted on the instrument panel within convenient view and reach of the operator. If space is not available, they may be mounted in other locations as long as they are visible and accessible. When the C-60 and the IN-14 are used, it is recommended that they be located near each other for operating convenience.

Location of CA-11A. The ARC Type CA-11A Computer Amplifier is shock-mounted on the ARC Type M-40A Mounting. It may be installed in any convenient location in the airplane. Allow sufficient clearance (at least 1/2 inch) on all sides of the computer amplifier for shock travel and ventilation, and sufficient space in front to permit easy removal from its mounting. The cable connection should be arranged so as not to restrict shock-mount travel.

Location of the monitor switch. The monitor switch of the ARC-20045 Monitor Switch and Cable Assembly should be mounted on a bracket, preferably on the left side of the control wheel. It is connected to the S-10 or C-60 through the cable provided.

Circuit protection and power control. Circuit protection for a 1-ampere load should be provided in the primary power lead to the CA-11A Computer Amplifier. A switch to control the application of power should be provided within reach of the pilot.

2-2. INSTALLATION OF COMPUTER AMPLIFIER AND MOUNTING.

Installation dimensions for the ARC Type CA-11A Computer Amplifier installed on the ARC Type M-40A Mounting are shown in Figure 2-1. Dimensions for the M-40A alone are shown in Figure 2-2. To install the CA-11A and M-40A proceed as follows:

Step 1. Drill the aircraft mounting surface for eight No. 6 binding-head machine screws, located as shown in Figure 2-2.

Step 2. Insert the screws through the holes in the lower plate of the M-40A. Place the M-40A in position and secure with nuts and lockwashers. The mounting surface should be clean, bare metal.

Step 3. Open the snapslide on the front of the CA-11A. Place the CA-11A on the M-40A making sure that the two bushings on the rear of the CA-11A engage the two studs at the rear of the M-40A. Press down slightly on the top of the CA-11A and close the snapslide to secure.

Note

The CA-11A can also be mounted vertically in an ARC Series 40 Modular Mounting. In this case, replace the guide pins of J101 with 5/32 in., 4-40 fillister-head machine screws and use an ARC-22236 Plate (instead of the ARC-21767 Hood supplied) with the ARC-21766 connector supplied. Refer to paragraph 2-7.

2-3. INSTALLATION OF DIRECTOR CONTROL OR COURSE INDICATOR.

Installation dimensions for the ARC Type S-10 Director Control and the ARC Type IN-14 Course Indicator are shown in Figures 2-3 and 2-4, respectively. Except for their depths, these instruments have the same mounting dimensions. Either instrument may be mounted from the front or rear of the mounting panel, using three No. 8-32 screws.

2-4. INSTALLATION OF CONTROL UNIT.

The ARC Type C-60 Control Unit is installed only if the ARC Type IN-14 Course Indicator is used in place of the ARC Type S-10 Director Control. Installation dimensions for the C-60 are shown in Figure 2-5.

2-5. INSTALLATION OF MONITOR SWITCH.

The Monitor Switch should be mounted on a bracket (not supplied with the Type CD-2), preferably on the left side of the control wheel.

2-6. INTERCONNECTION OF EQUIPMENT.

An interconnection diagram for the Type CD-2 using the S-10 Director Control is shown in Figure 2-6. The Type CD-2 with the S-10 may be used with any VOR or localizer equipment having a standard cross-pointer meter output (150-0-150 μa). Interconnection of the Type CD-2, using the C-60 and IN-14 with ARC Type 15D VOR equipment, is shown in Figure 2-7. Figure 2-7 is adaptable for use with ARC Type 15C, or later, VOR equipment. Figure 2-8 shows the interconnections when using the CA-11A and C-60 with an ID-249( )/ARN, ID-351A/ARN, or ID-357/ARN Course Indicator.

Note

For proper course director operation, it is essential that no other loads be connected in parallel with the vertical needle movement of the cross-pointer meter used with the CA-11A. Connect all other loads—such as additional vertical pointers, and zero readers and loading resistors, or both—across VOR-localizer equipment output terminals.

The CA-11A Computer Amplifier requires a 115-volt, 400-cps source of power. Power for the CA-11A must be obtained from the same source and phase (the "dim" phase) that excites the transmitter synchro in the stabilized heading source. Standard practices for aircraft synchro work are contained in the ARINC Synchro System Manual.

Note

Improper operation will result from failure to obtain power for the CA-11A from the same source and phase that excites the heading synchro.

The flag-alarm circuit will be interrupted when the S-10 function switch is in the MAG HDG position by connecting the circuit as shown in Figure 2-6. The C-60 will interrupt the flag-alarm and the to-from meter circuits, when it is set to the MAG HDG position, by connecting the circuits as shown in Figure 2-7. Both the flag-alarm and the to-from meter circuits of ARC's Type 15C, or later, VOR equipment may be interrupted without impairing operation. Interruption of the to-from meter circuit of other VOR equipments should be carefully investigated before proceeding.

2-7. CONNECTION OF EXTERNAL WIRING TO CA-11A.

External wiring to the CA-11A Computer Amplifier is accomplished with the ARC-21766 connector. This connector, with the necessary hood and attaching hardware, is part of the ARC-22446 Connectory Assembly Kit supplied. As shipped, the connector contacts are separate from the body of the connector. Connect the wiring to the connector as follows:

Step 1. If attached, remove the hood from the connector, loosen the cable clamp on the hood, and slip the hood (clamp end first) over the wires to be connected.

Step 2. Insert the contacts part way into the plastic body of the connector, and solder the wires to the contacts as indicated on the appropriate interconnection diagram.

Step 3. Push each contact into the connector until it seats.

Note

Wires may be soldered to contacts before contacts are inserted in body of connector. Do not allow excess solder to flow on outside of contacts. To remove contacts from connector, use ARC-22001 and ARC-22002 Contact Removing Tools.

Step 4. Attach the hood to the connector shell with the fillister-head machine screws provided.

Step 5. Tighten the cable clamp on the hood to secure the wires and eliminate strain on the contacts.

Step 6. Connect the connector to J101 of the CA-11A and lock-wire it by means of the holes in the guide pins.

2-8. OPERATIONAL CHECK.

Step 1. Interconnect the units of the ARC Type CD-2 Course Director, and the equipment with which it is to be used, as shown in Figure 2-6. If the Type CD-2 is used with an ARC Type 15D VOR equipment, see Figure 2-7.

Step 2. Turn on the primary power and allow a warm-up period of about 30 seconds.

Note

To maintain 115-volt, 400 cycle primary power, engines must be running or external source must be used.

Step 3. Turn VOR-localizer receiver off.

Step 4. Cage the directional gyro used as the stabilized heading source and set it to read 0°.

Step 5. Set the S-10 function switch to the OMNI LOC BLUE RIGHT position (or C-60 function switch to CD OMNI) and set the pointer of the S-10 or IN-14 to 0°. The vertical needle of the cross-pointer meter should center.

Step 6. Set the S-10 or IN-14 Pointer to 42°. The vertical needle of the cross-pointer meter should deflect 5 "dots" to the right (150-μa position). Wait one full minute for needle to reach final position.

Step 7. If the vertical needle does not deflect 5 "dots," adjust the heading-control potentiometer on the front of the CA-11A slowly until required deflection is obtained. Wait after each adjustment for needle to settle.

Step 8. Set the S-10 or IN-14 pointer to 318°. The vertical needle of the cross-pointer meter should deflect approximately 5 "dots" to the left (±1/2 "dot"). If the vertical needle does not deflect 5 "dots" (±1/2 "dot"), check all wiring.

Step 9. Turn VOR-localizer receiver on. Set the S-10 function switch to STANDBY, or the C-60 function switch to OMNI ONLY or LOC ONLY, as desired. In these positions the VOR or localizer signal is presented on the cross-pointer meter without the addition of the magnetic heading signal. Tune to a VOR or localizer station and check that the direction of vertical-needle deflection is correct. An ARC Type H-14 or H-14A Signal Generator may be used instead of a station. This test is necessary to check the cable connections.

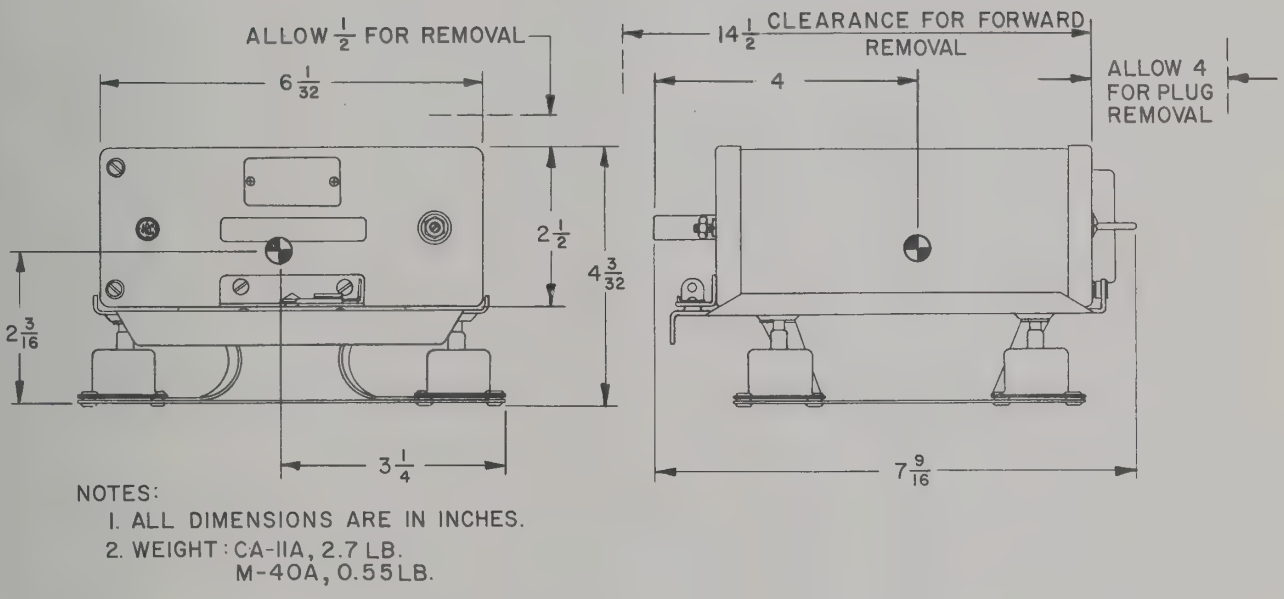
Note

The S-10 does not provide automatic set-up of the associated equipment for VOR or localizer operation; this must be performed by other means. With the C-60, the selection of VOR or localizer operation is performed by the C-60 switch and is not affected by any external function switching. If the C-60 is used, remove any external VOR-localizer selector switch.

Step 10. If the S-10 is used: Turn VOR-localizer receiver "off." Set the S-10 pointer to 10°. Switch the

S-10 function switch to OMNI LOC BLUE RIGHT. The vertical needle of the cross-pointer meter should deflect to the right, then slowly return almost to the center. This test checks the crosswind compensation provided by the Type CD-2.

Step 11. If the C-60 and IN-14 are used: Turn the VOR-localizer receiver "off." Set the C-60 function switch to LOC ONLY. Set the IN-14 pointer to 10°. Switch the C-60 function switch to CD LOC BLUE RIGHT. The vertical needle of the cross-pointer meter should move to the right, then slowly return almost to the center. This test checks the crosswind compensation provided by the Type CD-2.



NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT: CA-11A, 2.7 LB.
M-40A, 0.55 LB.

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Figure 2-1. ARC Type CA-11A Computer Amplifier with ARC Type M-40A Mounting, Outline Dimensions

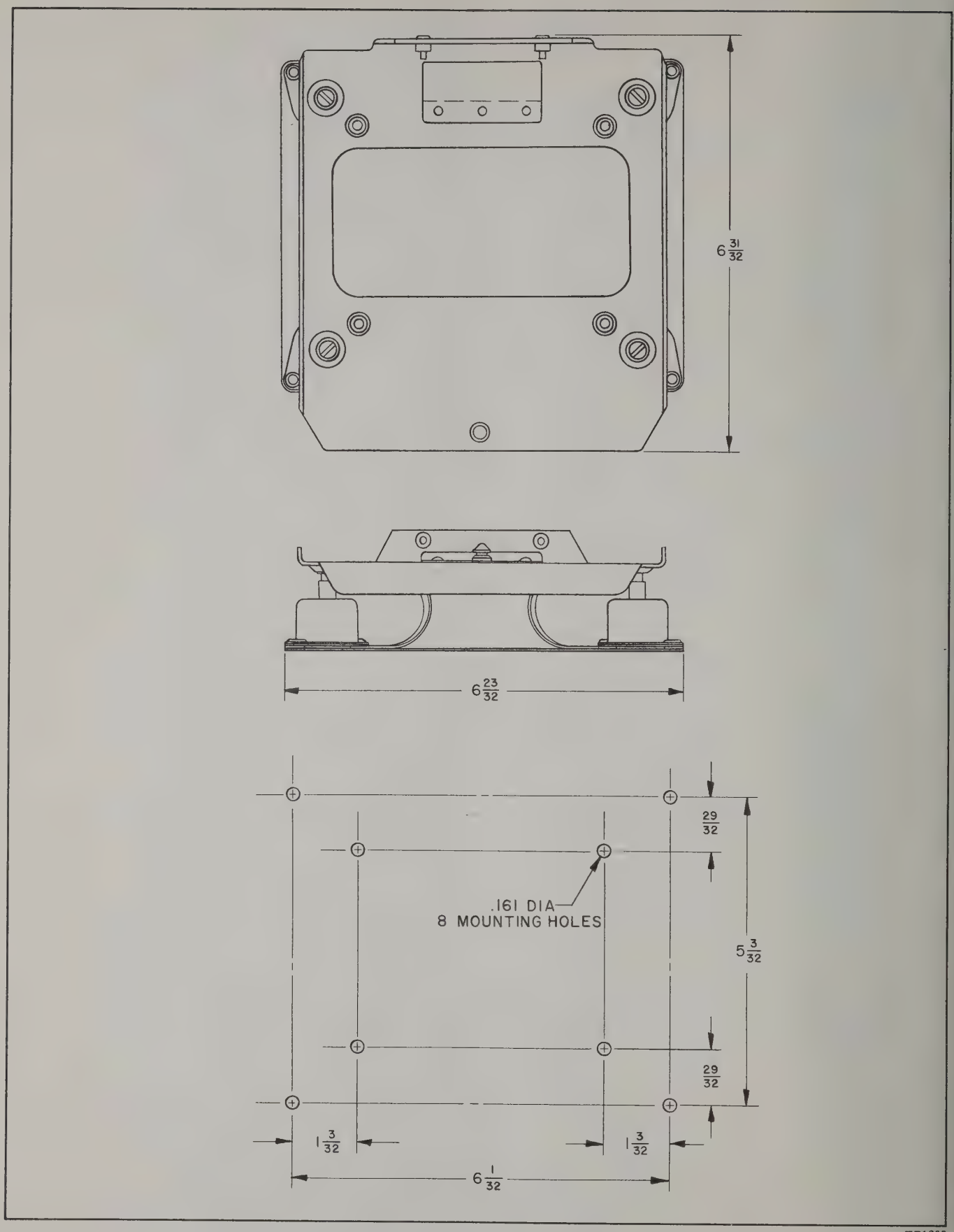

Figure 2-2. ARC Type M-40A Mounting, Outline Dimensions

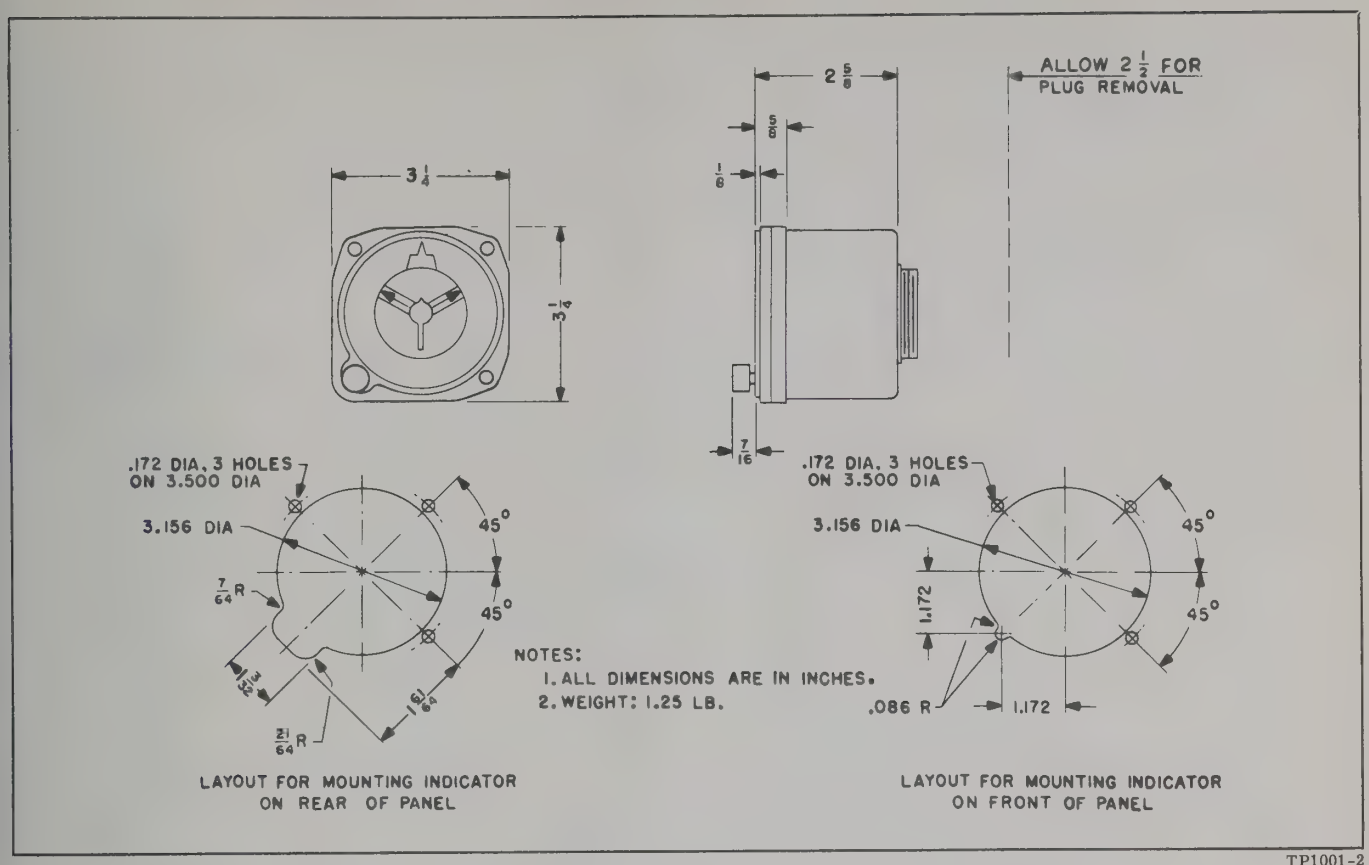

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Figure 2-3. ARC Type S-10 Director Control, Outline Dimensions

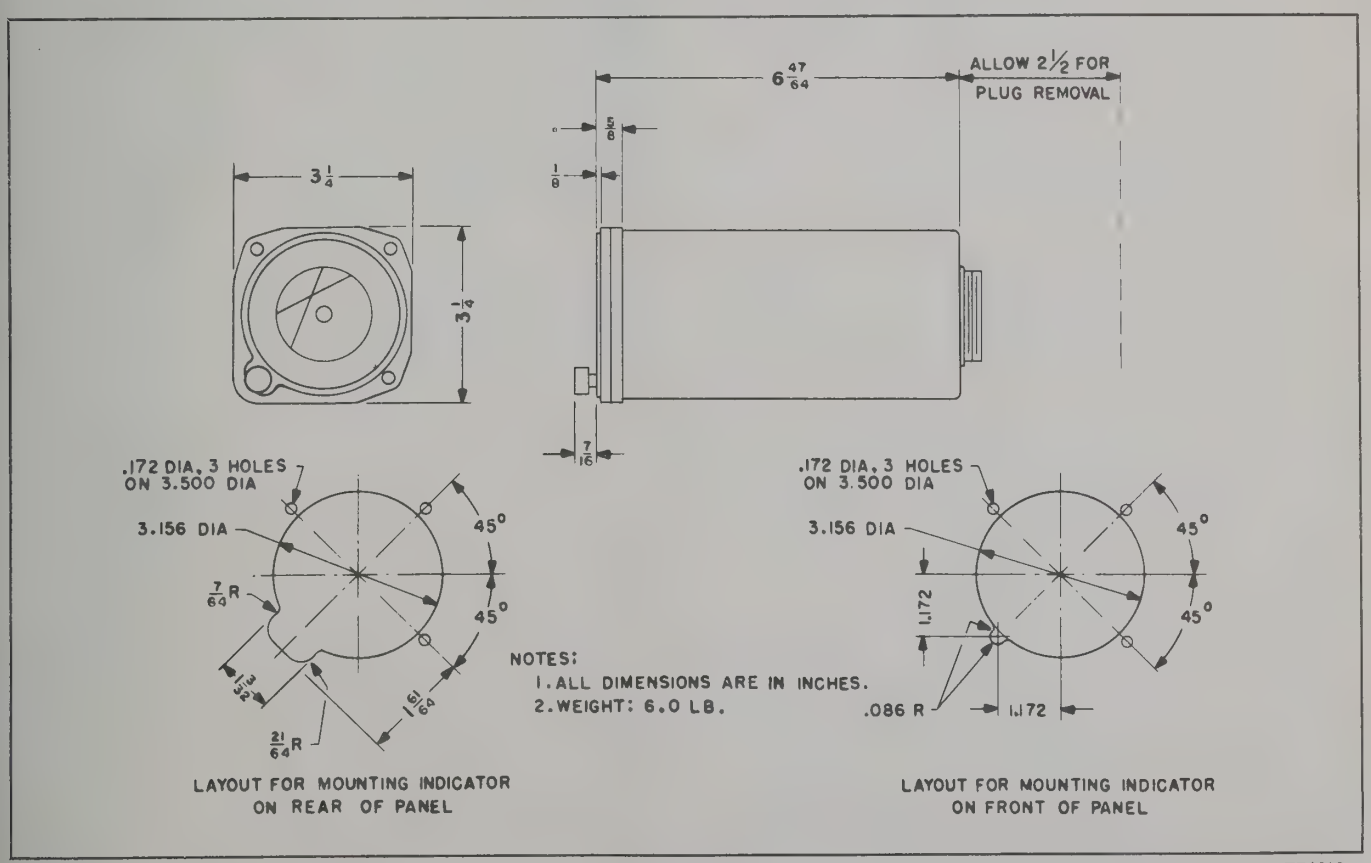

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Figure 2-4. ARC Type IN-14 Course Indicator, Outline Dimensions

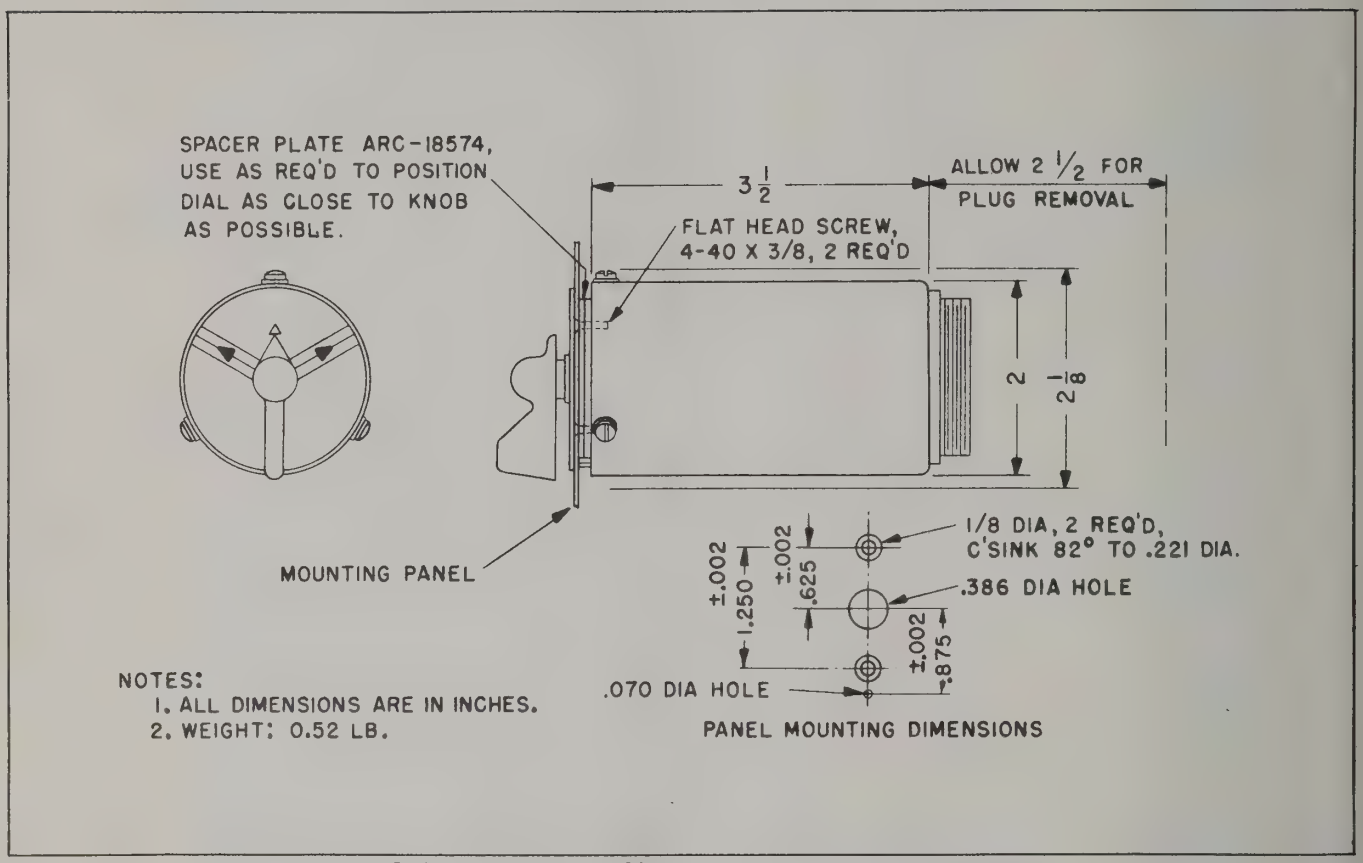


Figure 2-5. ARC Type C-60 Control Unit, Outline Dimensions TP1017A

NOTES:

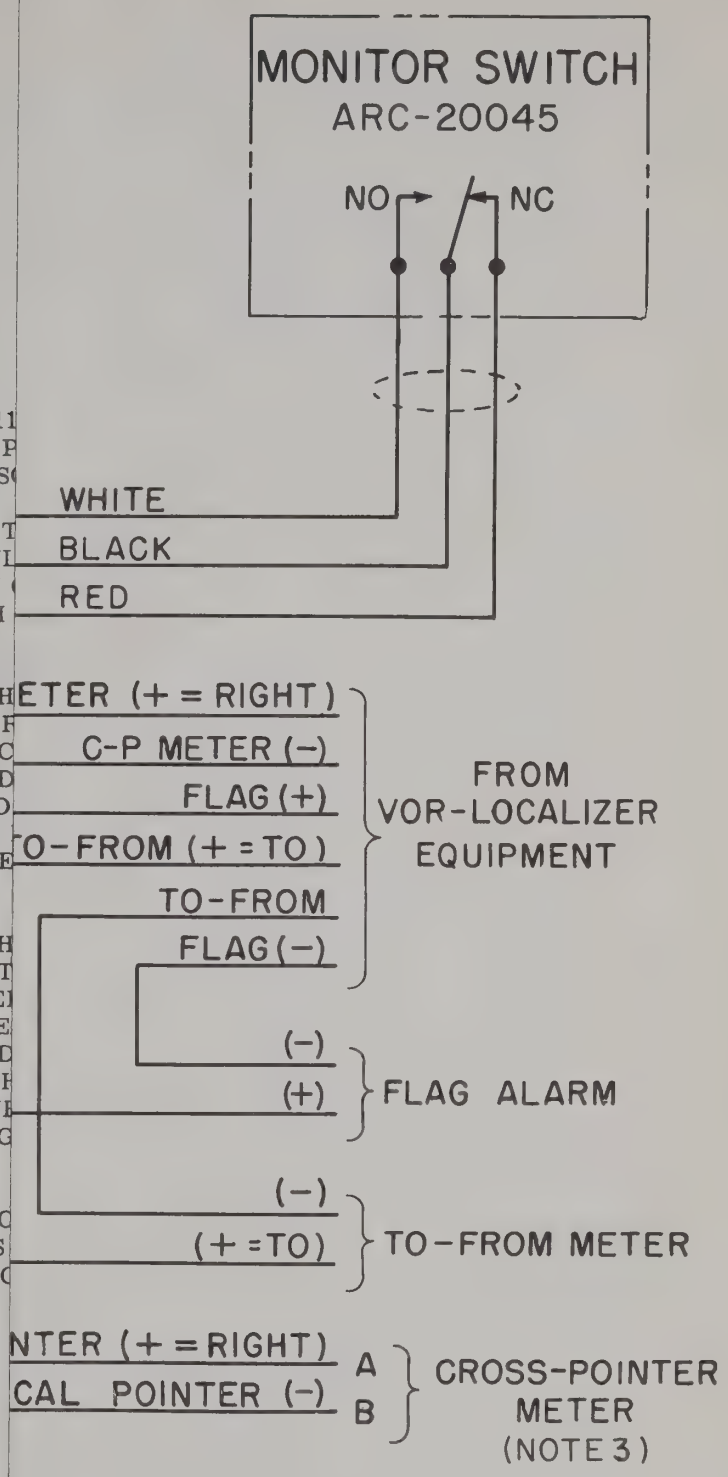
1. 115V 400~ POWER TO CA-11 BE OF SAME SOURCE AND P EXCITATION TO HEADING S(

2. ALL WIRES ARE #20 AWG ST COPPER, FIBERGLAS INSUL EXCEPT MONITOR SWITCH (WHICH IS FURNISHED WITH SWITCH.

3. DO NOT CONNECT ANY OTH IN PARALLEL WITH THE CF POINTER METER. CONNEC OTHER LOADS, SUCH AS AD VERTICAL POINTER, ZERO AND/OR LOAD RESISTORS, TO C-P METER OUTPUT TE OF VOR-LOC EQUIPMENT.

4. IF LEADS TO STABILIZED H SOURCE ARE BUNDLED WIT AC LEADS, OR ARE ROUTE HIGH RF NOISE LEVEL ARE SHIELDED WIRING. SHIELD SHOULD BE OF THE TYPE H INSULATING COVERING OVE SHIELDING, WITH SHIELD G AT BOTH ENDS.

5. DESIGNATION OF LEADS TO LIZED HEADING SOURCE IS ACCORDANCE WITH "ARINC STANDARDS.



21736A

Figure 2-6. ARC Type CD-2 Course Director, Interconnection Diagram

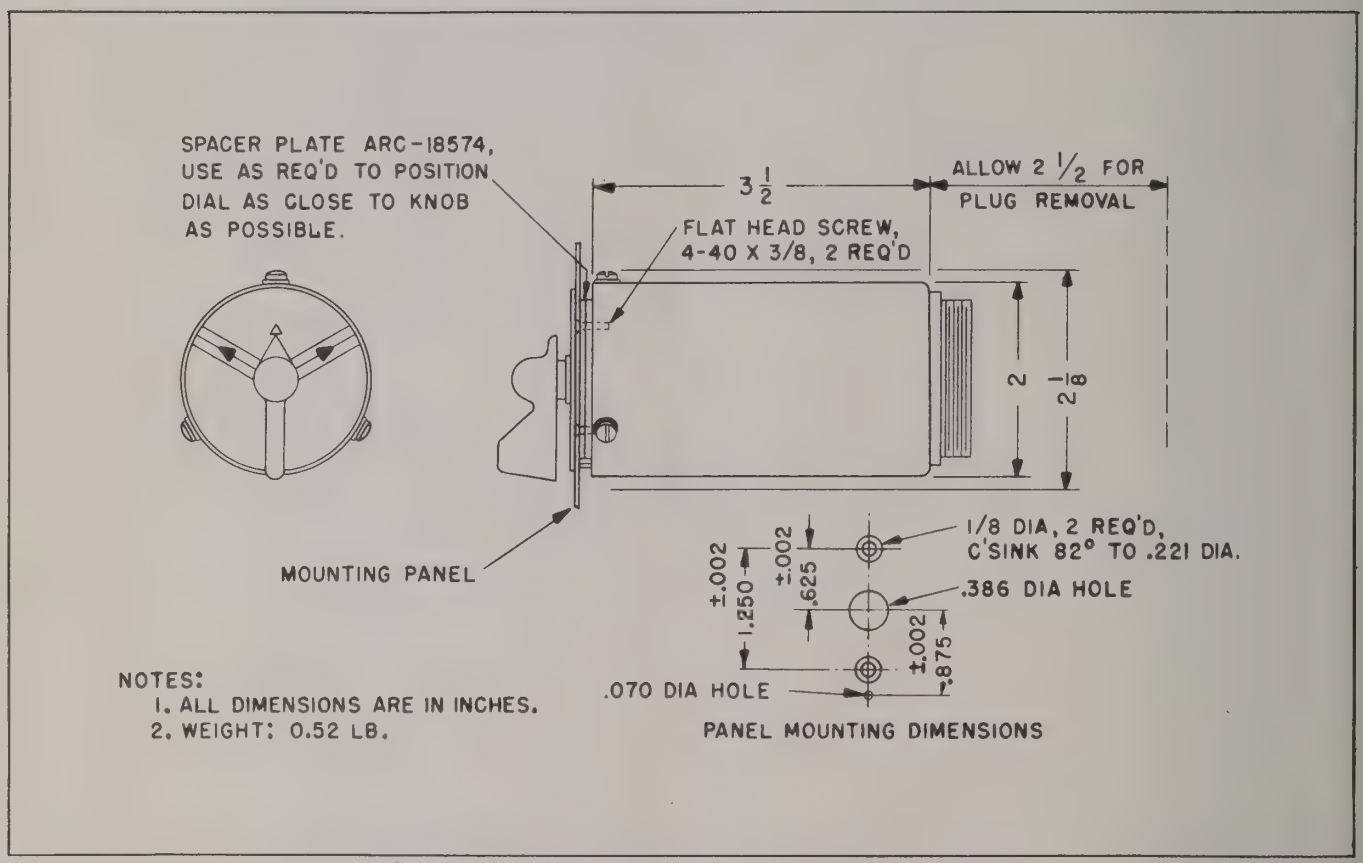
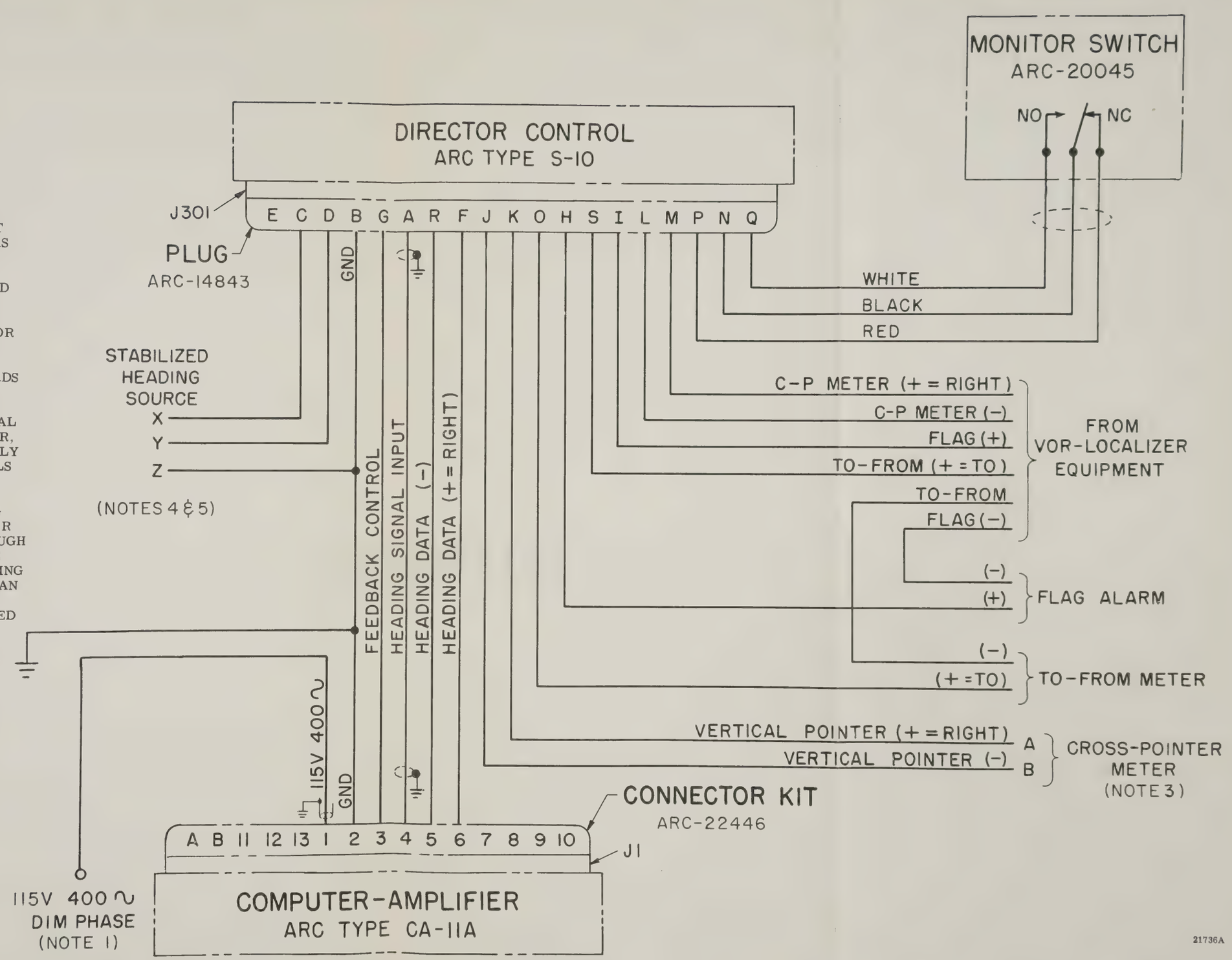


Figure 2-5. ARC Type C-60 Control Unit, Outline Dimensions TP1017A

NOTES:

1. 115V 400~ POWER TO CA-11A MUST BE OF SAME SOURCE AND PHASE AS EXCITATION TO HEADING SOURCE.
2. ALL WIRES ARE #20 AWG STRANDED COPPER, FIBERGLAS INSULATED, EXCEPT MONITOR SWITCH CABLE WHICH IS FURNISHED WITH MONITOR SWITCH.
3. DO NOT CONNECT ANY OTHER LOADS IN PARALLEL WITH THE CROSS-POINTER METER. CONNECT ALL OTHER LOADS, SUCH AS ADDITIONAL VERTICAL POINTER, ZERO READER, AND/OR LOAD RESISTORS, DIRECTLY TO C-P METER OUTPUT TERMINALS OF VOR-LOC EQUIPMENT.
4. IF LEADS TO STABILIZED HEADING SOURCE ARE BUNDLED WITH OTHER AC LEADS, OR ARE ROUTED THROUGH HIGH RF NOISE LEVEL AREAS, USE SHIELDED WIRING. SHIELDED WIRING SHOULD BE OF THE TYPE HAVING AN INSULATING COVERING OVER THE SHIELDING, WITH SHIELD GROUNDED AT BOTH ENDS.
5. DESIGNATION OF LEADS TO STABILIZED HEADING SOURCE IS IN ACCORDANCE WITH "ARINC" STANDARDS.



21736A

Figure 2-6. ARC Type CD-2 Course Director, Interconnection Diagram

NOTES:

1. 115V 400~ POWER TO CA-11A MUST BE OF SAME SOURCE AND PHASE AS EXCITATION TO THE HEADING SOURC

2. UNMARKED WIRES ARE #20 AWG STRANDED COPPER, FIBERGLAS INSULATED, EXCEPT MONITOR SWITCH CABLE WHICH IS FURNISHED WITH MONITOR SWITCH. WIRES MARKED WITH ASTERISK (*) ARE #16 AWG STRANDED COPPER, FIBERGLAS INSULATED.

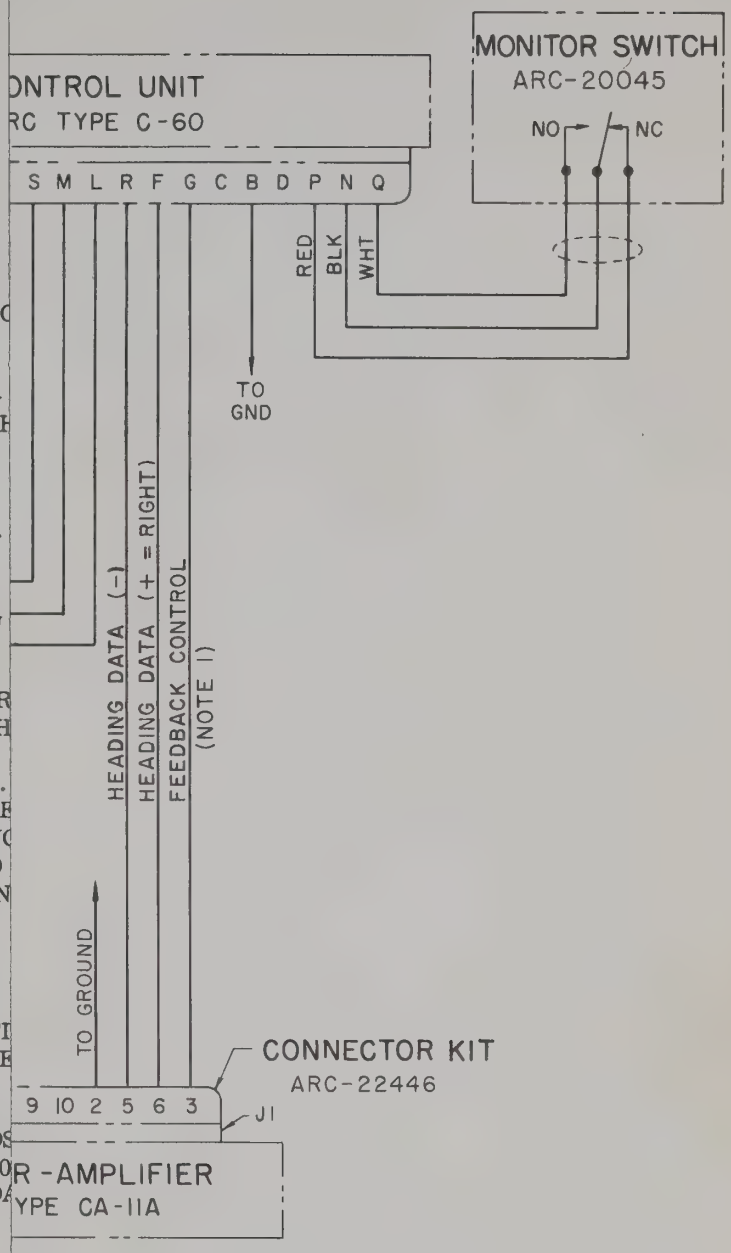
3. THE MINIMUM REQUIRED SHIELDING IS SHOWN. IF SYNCHRO WIRING (WIRES MARKED BY * *) IS TO BE BUNDLED WITH OTHER AC LEADS OR IS ROUTED THROUGH AREAS OF HIGH LEVEL RF NOISE, SHIELDING OF SYNCHRO WIRING IS RECOMMENDED. ALL SHIELDED WIRE SHOULD BE THE TYPE WITH AN INSULATED COVERING OVER THE SHIELDING, WITH SHIELD GROUNDED AT BOTH ENDS AS SHOWN

4. TUNING METER TO HAVE 0-1 MA MOVEMENT.

5. CONTROL UNIT C-22A, WITH MOUNTI M-18 AND CONTROL UNIT C-1254 ARE ALTERNATIVE UNITS.

6. DO NOT CONNECT ANY OTHER LOADS ACROSS TERMINALS A AND B OF J160 OF IN-14. CONNECT ALL OTHER LOA SUCH AS ADDITIONAL VERTICAL POINTER, ZERO READER, ETC. ACROSS TERMINALS G AND H OF J306 OF E-14.

7. DESIGNATION OF LEADS TO STABILIZED HEADING SOURCE IS IN ACCORDANCE WITH "ARINC" STANDARDS.

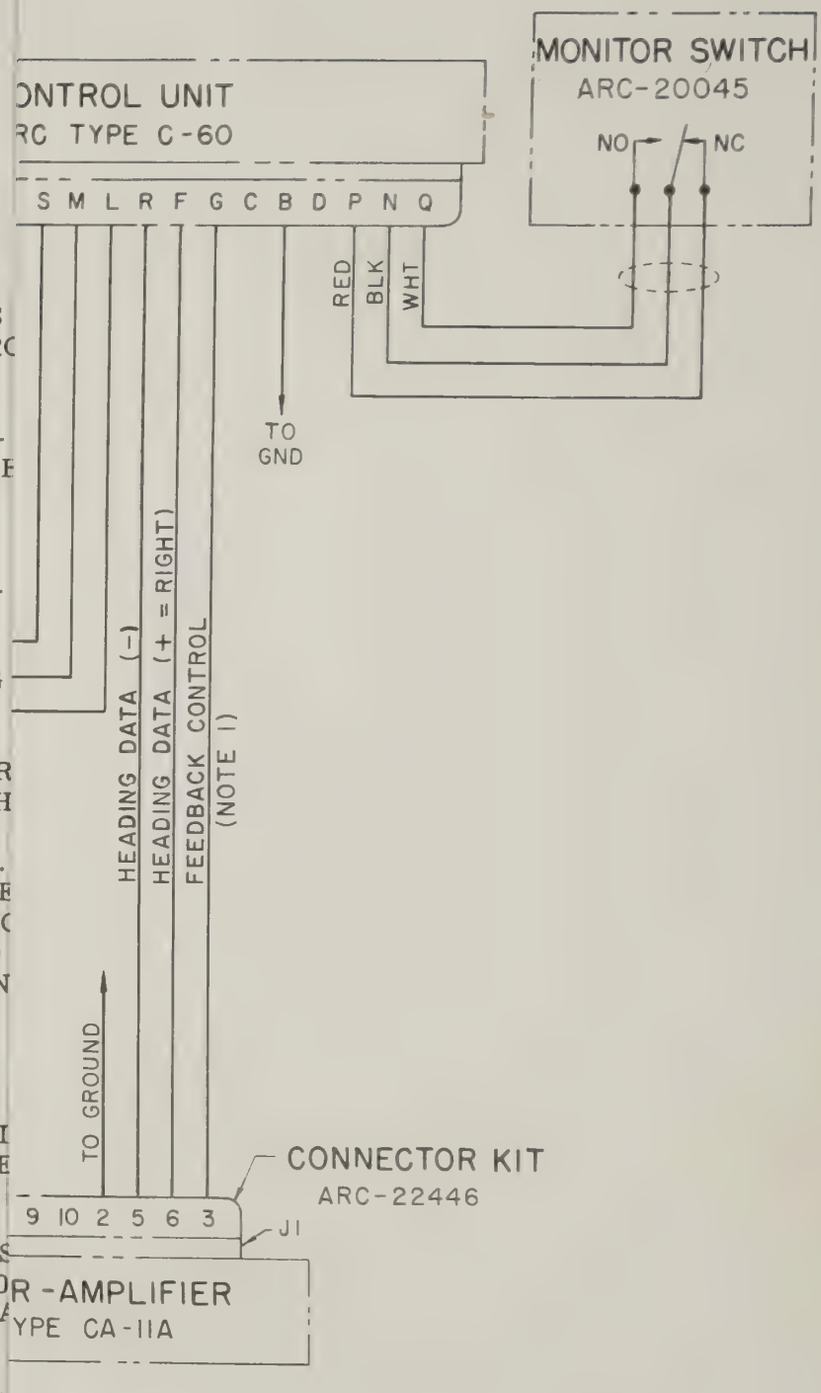


21738A

2-7. ARC Type CD-2 Course Director and ARC Type 15D VOR Equipment, Interconnection Diagram

NOTES:

1. 115V 400~ POWER TO CA-11A MUST BE OF SAME SOURCE AND PHASE AS EXCITATION TO THE HEADING SOURC
2. UNMARKED WIRES ARE #20 AWG STRANDED COPPER, FIBERGLAS INSULATED, EXCEPT MONITOR SWITCH CABLE WHICH IS FURNISHED WITH MONITOR SWITCH. WIRES MARKED WITH ASTERISK (*) ARE #16 AWG STRANDED COPPER, FIBERGLAS INSULATED.
3. THE MINIMUM REQUIRED SHIELDING IS SHOWN. IF SYNCHRO WIRING (WIRES MARKED BY * *) IS TO BE BUNDLED WITH OTHER AC LEADS OR IS ROUTED THROUGH AREAS OF HIGH LEVEL RF NOISE, SHIELDING OF SYNCHRO WIRING IS RECOMMENDED. ALL SHIELDED WIRE SHOULD BE THE TYPE WITH AN INSULATED COVERING OVER THE SHIELDING, WITH SHIELD GROUNDED AT BOTH ENDS AS SHOWN
4. TUNING METER TO HAVE 0-1 MA MOVEMENT.
5. CONTROL UNIT C-22A, WITH MOUNTI M-18 AND CONTROL UNIT C-1254 ARE ALTERNATIVE UNITS.
6. DO NOT CONNECT ANY OTHER LOADS ACROSS TERMINALS A AND B OF J160 OF IN-14. CONNECT ALL OTHER LOA SUCH AS ADDITIONAL VERTICAL POINTER, ZERO READER, ETC. ACROSS TERMINALS G AND H OF J306 OF E-14.
7. DESIGNATION OF LEADS TO STABILIZED HEADING SOURCE IS IN ACCORDANCE WITH "ARINC" STANDARDS.



21738A

2-7. ARC Type CD-2 Course Director and ARC Type 15D VOR Equipment, Interconnection Diagram

NOTES:

1. 115V 400~ POWER TO CA-11A MUST BE OF SAME SOURCE AND PHASE AS EXCITATION TO THE HEADING SOURCE.

2. UNMARKED WIRES ARE #20 AWG STRANDED COPPER, FIBERGLAS INSULATED, EXCEPT MONITOR SWITCH CABLE WHICH IS FURNISHED WITH MONITOR SWITCH. WIRES MARKED WITH ASTERISK (*) ARE #16 AWG STRANDED COPPER, FIBERGLAS INSULATED.

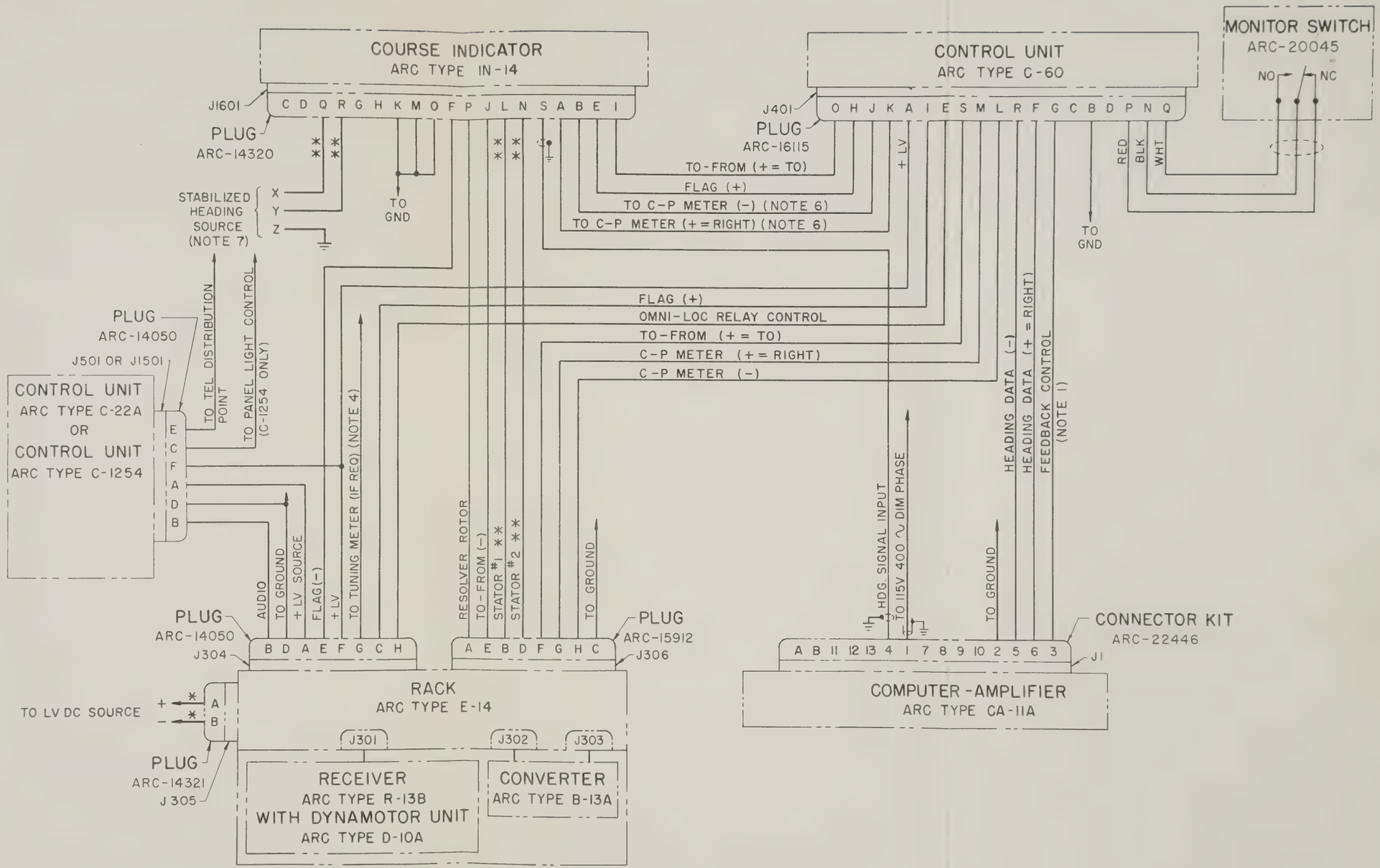
3. THE MINIMUM REQUIRED SHIELDING IS SHOWN. IF SYNCHRO WIRING (WIRES MARKED BY * *) IS TO BE BUNDLED WITH OTHER AC LEADS OR IS ROUTED THROUGH AREAS OF HIGH LEVEL RF NOISE, SHIELDING OF SYNCHRO WIRING IS RECOMMENDED. ALL SHIELDED WIRE SHOULD BE THE TYPE WITH AN INSULATED COVERING OVER THE SHIELDING, WITH SHIELD GROUNDED AT BOTH ENDS AS SHOWN.

4. TUNING METER TO HAVE 0-1 MA MOVEMENT.

5. CONTROL UNIT C-22A, WITH MOUNTING M-18 AND CONTROL UNIT C-1254 ARE ALTERNATIVE UNITS.

6. DO NOT CONNECT ANY OTHER LOADS ACROSS TERMINALS A AND B OF J1601 OF IN-14. CONNECT ALL OTHER LOADS SUCH AS ADDITIONAL VERTICAL POINTER, ZERO READER, ETC. ACROSS TERMINALS G AND H OF J306 OF E-14.

7. DESIGNATION OF LEADS TO STABILIZED HEADING SOURCE IS IN ACCORDANCE WITH "ARINC" STANDARDS.



21738A

Figure 2-7. ARC Type CD-2 Course Director and ARC Type 15D VOR Equipment, Interconnection Diagram

NOTES:

1. ALL WIRES ARE #20 AWG STRANDE
   EXCEPT MONITOR-SWITCH CABLE
   SWITCH.

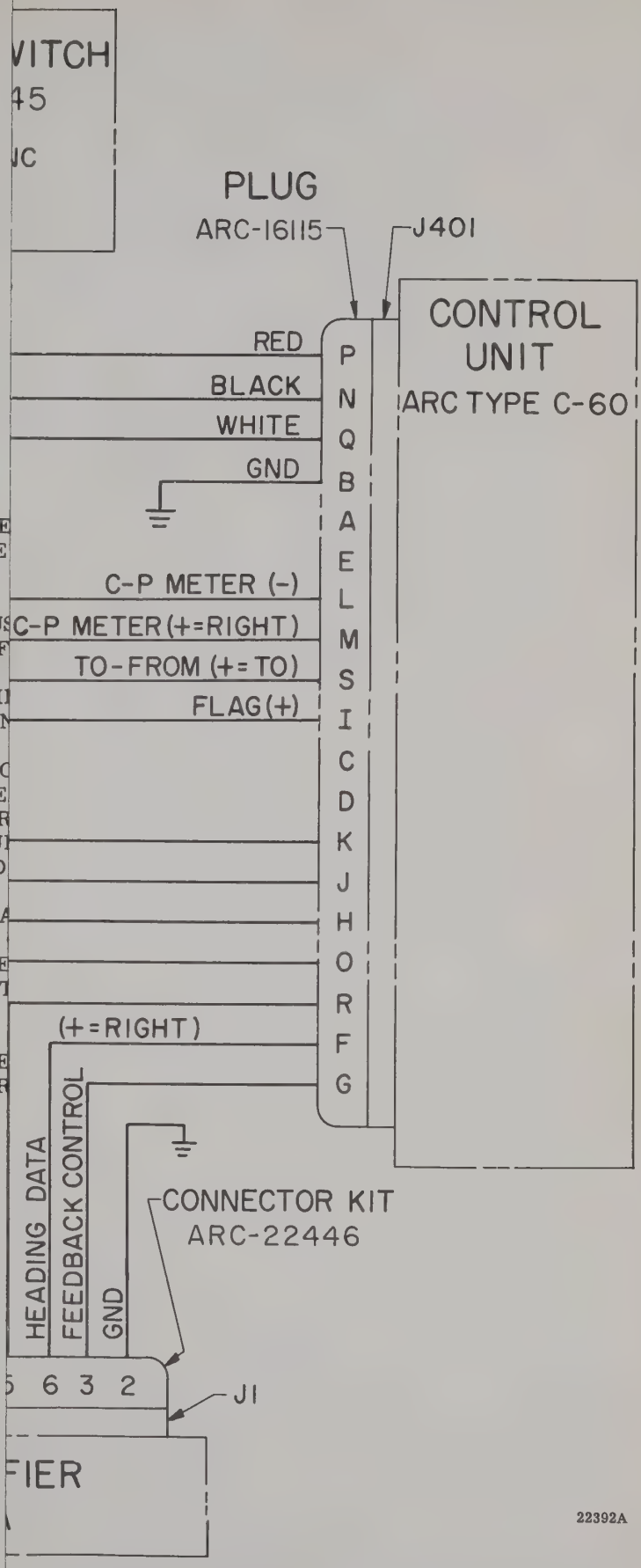
2. 115V, 400~ POWER TO CA-11A MUS
   PHASE ("DIM") AS EXCITATION OF

3. DESIGNATION OF LEADS TO STABI
   ACCORDANCE WITH "ARINC" STAN

4. IF LEADS TO STABILIZED HEADINC
   OTHER AC LEADS, OR ARE ROUTE
   LEVEL AREAS, USE SHIELDED WIR
   BE OF THE TYPE HAVING AN INSU
   SHIELDING, WITH SHIELD GROUND

5. DO NOT CONNECT ANY OTHER LOA
   POINTER METER. CONNECT ALL
   VERTICAL POINTER. ZERO READE
   DIRECTLY TO C-P METER OUTPUT
   MENT.

6. FOR OTHER CONNECTIONS TO THE
   INSTALLATION INSTRUCTIONS FOR



-8. ARC Type CD-2 Course Director with ID-249 ( )/ARN,
351A/ARN, or ID-357/ARN, Interconnection Diagram

NOTES:

1. ALL WIRES ARE #20 AWG STRANDED COPPER, FIBERGLAS INSULATED, EXCEPT MONITOR-SWITCH CABLE WHICH IS FURNISHED WITH MONITOR SWITCH.

2. 115V, 400~ POWER TO CA-11A MUST BE FROM SAME SOURCE AND PHASE ("DIM") AS EXCITATION OF STABILIZED HEADING SOURCE.

3. DESIGNATION OF LEADS TO STABILIZED HEADING SOURCE IS IN ACCORDANCE WITH "ARINC" STANDARDS.

4. IF LEADS TO STABILIZED HEADING SOURCE ARE BUNDLED WITH OTHER AC LEADS, OR ARE ROUTED THROUGH HIGH RF NOISE LEVEL AREAS, USE SHIELDED WIRING. SHIELDED WIRING SHOULD BE OF THE TYPE HAVING AN INSULATING COVERING OVER THE SHIELDING, WITH SHIELD GROUNDED AT BOTH ENDS.

5. DO NOT CONNECT ANY OTHER LOADS IN PARALLEL WITH THE CROSS-POINTER METER. CONNECT ALL OTHER LOADS, SUCH AS ADDITIONAL VERTICAL POINTER, ZERO READER, AND/OR LOAD RESISTORS, DIRECTLY TO C-P METER OUTPUT TERMINALS OF VOR-LOC EQUIPMENT.

6. FOR OTHER CONNECTIONS TO THE COURSE INDICATOR, SEE INSTALLATION INSTRUCTIONS FOR INDICATOR USED.

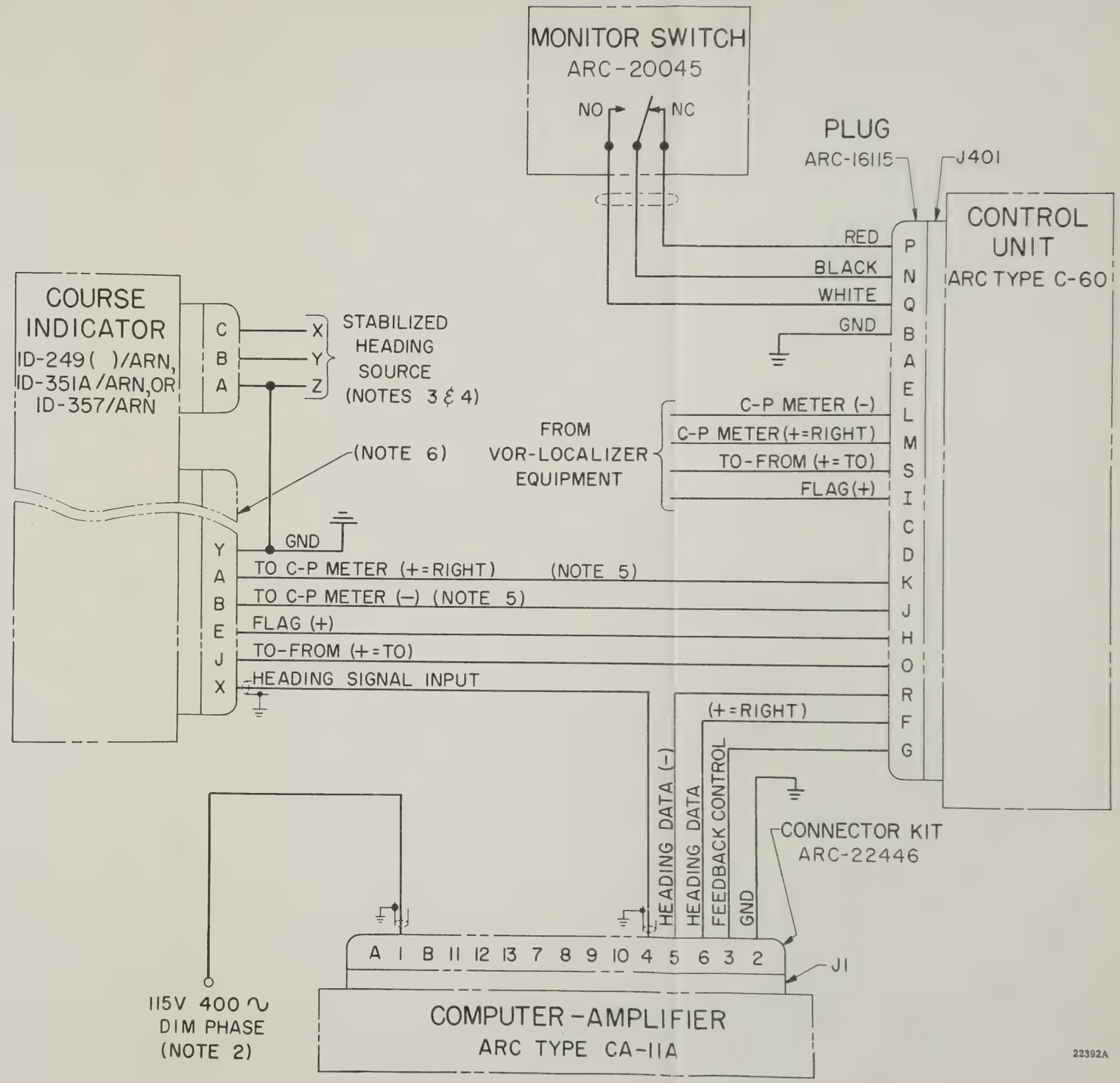


Figure 2-8. ARC Type CD-2 Course Director with ID-249 ( )/ARN, ID-351A/ARN,or ID-357/ARN, Interconnection Diagram

SECTION III

OPERATION

3-1. INTRODUCTION.

The ARC Type CD-2 Course Director is designed for use with a stabilized heading source and VOR-localizer receiving equipment. When so used, the Type CD-2 provides computed steering data for en route tracking on VOR and for ILS approaches. Without VOR-localizer equipment, but with a stabilized heading source, the Type CD-2 provides a convenient indication of any deviation from the desired heading.

The Type CD-2 control and/or indicator used is dependent on the associated type of equipment. The ARC Type S-10 Director Control may be used with any VOR equipment which is designed to provide standard course sensitivity, and to operate a standard 1,000-ohm, ±150 microampere-movement meter, such as the ARC-13310 or ID-45/ARN. The ARC Type C-60 Control Unit and ARC Type IN-14 Course Indicator, however, may be used only with ARC Type 15C, or later, VOR equipment. The C-60 may also be used with a course indicator such as the ID-249( )/ARN, ID-351A/ARN, or ID-357/ARN.

The information contained in this section is applicable to either type of instrument installation (S-10 or C-60) unless otherwise noted. Whenever reference is made to the ARC Type IN-14 Course Indicator, the statement also applies to instruments such as the ID-249( )/ARN Course Indicator, with one exception: the ID-249( )/ARN presents course information digitally; the IN-14 uses a pointer and circular dial.

3-2. CONTROL FUNCTIONS.

The operative functions of the Type CD-2 are controlled by a selector switch located on either the S-10 or the C-60. Table 3-1 describes the use of each position of the S-10 and C-60 function switches. The knob on the IN-14 permits the selection of a track to or from a VOR station and/or the heading information for the Type CD-2. (If the IN-14 is not used, the functions of this control are duplicated on the equivalent omnirange bearing selector and on the S-10.) These controls are shown in Figures 3-1, 3-2, and 3-3.

3-3. PREFLIGHT CHECK AND TURN-ON PROCEDURE.

Step 1. Apply primary power to equipment (engine running). Allow 30 seconds for warm-up.

Step 2. Cage and set the directional gyro.

Step 3. Ungage gyro and set S-10 or C-60 function switch to MAG HDG. Rotate S-10 or IN-14 pointer to agree with gyro card indication. The vertical needle of the cross-pointer meter should center.

Step 4. Turn on VOR equipment and tune in a VOR test signal (VOT), such as that from an ARC Type H-14 or H-14A Signal Generator.

Step 5. If S-10 is used:

a. Set S-10 function switch to STANDBY and rotate the course selector knob of the VOR equipment to center the vertical needle of the cross-pointer meter.

b. Set S-10 pointer to setting of the course selector pointer. Cage the directional gyro and set to heading indicated by S-10 pointer and course selector pointer.

c. Switch the S-10 function switch to OMNI LOC BLUE RIGHT. The vertical needle of the cross-pointer meter should remain centered.

Step 6. If C-60 and IN-14 are used:

a. Set C-60 function switch to OMNI ONLY and rotate the IN-14 pointer set knob to center the vertical needle of the cross-pointer meter.

b. Cage the directional gyro and set to heading indicated by IN-14 pointer.

c. Switch the C-60 function switch to CD OMNI. The vertical needle of the cross-pointer meter should remain centered.

Figure 3-1. ARC Type S-10 Director Control, Front View

Figure 3-2. ARC Type C-60 Control Unit, Front View

Figure 3-3. ARC Type IN-14 Course Indicator, Front View

TABLE 3-1. CONTROL FUNCTIONS OF S-10 AND C-60

Switch Position	Use
S-10 Director Control	
OMNI LOC BLUE RIGHT	For all VOR operation, and for localizer operation when blue sector is on the right (front course).
STANDBY	VOR or localizer track only is presented on cross-pointer meter. Course Director computed steering data omitted.
LOC BLUE LEFT	For localizer operation when blue sector is on the left (back course).
MAG HDG[1]	Heading indication only is presented on cross-pointer meter. Radio navigation signal omitted.
C-60 Control Unit	
OMNI ONLY	VOR track only is presented on cross-pointer meter. Course Director computed steering data omitted.
CD OMNI	For all VOR operation using the Course Director.
CD LOC BLUE RIGHT	For localizer operation using the Course Director when the blue sector is on the right (front course).
LOC ONLY	Localizer track only is presented on cross-pointer meter. Course Director computed steering data omitted.
CD LOC BLUE LEFT	For localizer operation using the Course Director when the blue sector is on the left (back course).
MAG HDG[1]	Heading indication only is presented on cross-pointer meter. Radio navigation signal omitted.

[1]In this position, cross-pointer meter flag alarm will be up, and to-from meter will not operate, indicating that magnetic heading information only is being presented. (Refer to Paragraph 2-6.)

3-4. MAGNETIC HEADING (MAG HDG) OPERATION.

General. The setting of the S-10 or IN-14 pointer informs the computer amplifier of the desired magnetic heading. The directional gyro operates electrically to inform the computer amplifier of the aircraft's actual magnetic heading at all times.

With the function switch in the MAG HDG position, all radio information is removed from the cross-pointer meter. The S-10 or IN-14 may be set to a heading it is desired to maintain. Turning the aircraft "into the needle" until the needle is centered will orient the aircraft on the desired heading. If the aircraft heading deviates from the manually set heading approximately ±15 degrees, or more, right or left full-scale deflection will result. To make the desired magnetic heading good it is necessary to "steer into the needle."

The MAG HDG mode of operation will facilitate maintenance of heading during instrument take-off and cross-country magnetic-heading flying. By setting-in the runway heading on the S-10 or IN-14, and centering the vertical needle, directional steering information for take-off is provided on the cross-pointer meter. For cross-country flight, the desired heading is set-in, and the needle kept centered.

Procedure. To use the MAG HDG function, proceed as follows:

Step 1. Prepare the CD-2 for operation (paragraph 3-3). Set the S-10 or IN-14 pointer to the desired magnetic heading.

Step 2. Set the function switch to MAG HDG. (In this position all VOR or localizer information is removed from the cross-pointer meter.)

Step 3. Steer the aircraft "toward the needle" until the needle centers; that is, if the vertical needle is to the right of center, steer right; if to the left, steer left. With the needle centered, the aircraft is on the

desired magnetic heading.

Note

If the aircraft is steered away from the needle, the needle may center on the reciprocal heading. However, a deviation of 1/2° or more from this heading will require a full 180° turn before the needle centers again. Thus, the ambiguity is resolved almost automatically.

3-5. VOR OPERATION.

Interception of VOR Track. The CD-2 may be used to intercept and maintain a VOR track. The course director will resolve any intercept problem provided the aircraft is in an area approximately ±45° to the desired track (see Figure 3-4). In areas outside this limit (shaded portion of Figure 3-4) it may not be possible to center the needle. It is then necessary to fly to a "clear" area to effect an interception. This limitation applies to VOR only. If it is desired to intercept a track before getting to the station, the procedure should be started at a sufficient distance from the station. For medium-size aircraft, interception is possible if begun 2 to 3 miles from the station.

If the aircraft is sufficiently off-track, the course director establishes an initial heading to intercept the track at an angle of 40° or more. When the aircraft is flown to keep the vertical needle centered, the course director calls for heading changes to reduce the "cut" as the aircraft approaches the track until the aircraft is "on track" and on the proper heading. The course director is designed to get the aircraft on track, and then to maintain the track.

When the track is intercepted, the course director will provide the correct heading to make the track good. Compensation for crosswinds causing crab angles up to 15° or 20° on either side is automatic. Since the course director first intercepts and then makes the track good, the track is crossed slightly to the downwind side before full correction is applied. This "overshoot" is minor because the computer amplifier solves the crosswind difference rapidly.

Normally, when flying a VOR track with the S-10, the S-10 is set to correspond with the "course selector" or "omni bearing selector." But when crosswinds are strong enough to cause crab angles greater than 20°, the S-10 may be set 5° or 10° into the wind for greater compensation.

When using the IN-14 and C-60, the IN-14 sets up the VOR track and heading information simultaneously. Therefore, for VOR tracks only, it is not possible to introduce additional crosswind compensation since a change in the IN-14 setting also changes the VOR track. If the automatic crosswind compensation limit is exceeded, fly the needle one or two "dots" into the wind to make the VOR track good; that is, if the wind is from the left, fly with the vertical needle one or two "dots" to the right of center, and vice versa.

Procedure. To use the course director for VOR navigation (see Figure 3-5), proceed as follows:

Step 1. Prepare the course director for operation (paragraph 3-3). Set the S-10 or IN-14 pointer to the desired track.

Step 2. Set the S-10 function switch to OMNI LOC BLUE RIGHT, or the C-60 function switch to CD OMNI.

Step 3. Steer toward the needle until the needle centers. Continue to fly with the needle centered; the aircraft will intercept and maintain the desired VOR track.

3-6. LOCALIZER OPERATION.

General. The characteristics of a runway localizer signal differ from a VOR signal, and the course director responds accordingly. Solution of a localizer problem by the course director is not limited as it is for VOR operation (refer to paragraph 3-5). An initial intercept angle of 40° or more is established provided the aircraft is far enough from the desired track; it is not necessary to consider the aircraft's position with respect to the ground station to achieve an intercept solution. If the aircraft is to intercept the track before arriving at a specific point, the pilot must know his approximate position with respect to the ground station. The same rule applies to a runway localizer whether the front course or the back course is to be intercepted.

As in VOR operation, the course director intercepts, and then maintains the track. After setting the S-10 or IN-14 pointer to the published inbound heading (front course) of the localizer, the direction of flight is determined by setting the S-10 to LOC BLUE LEFT or the C-60 to CD LOC BLUE LEFT (back course), or the S-10

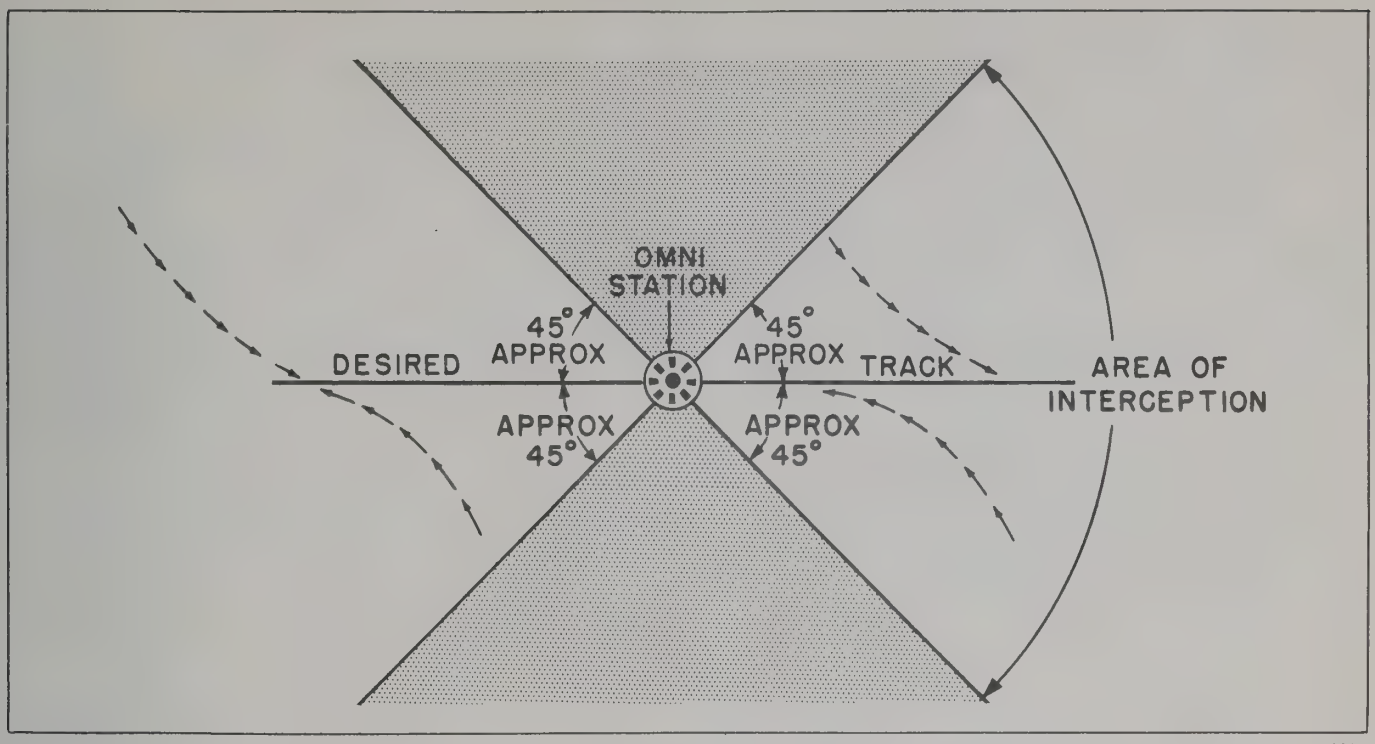


Figure 3-4. Areas of Possible VOR Track Interception

to OMNI LOC BLUE RIGHT or the C-60 to CD LOC BLUE RIGHT (front course). Typical front-course ILS approaches using the S-10 or C-60 are illustrated in Figures 3-6 and 3-7.

The course director will compensate for 15° to 20° of crab due to crosswind, for localizer operation. Additional crosswind compensation may be obtained by setting the S-10 or IN-14 pointer into the wind as necessary.

Caution

This use of the IN-14 applies only to localizer operation. Refer to paragraph 3-5.

During an ILS approach, changes in wind velocity and direction are compensated for automatically so that the aircraft is never permitted to maintain a heading which will result in getting off the track. Because of this feature, missed approaches caused by aircraft heading errors are eliminated. Since the course director will supply steering information to facilitate interception of a desired track, it is possible to use the standard 80° turn immediately after passing the outer marker outbound on an ILS approach. Medium-size aircraft may dispense with any procedure turn at approach speeds. Typical ILS approaches with 45° and 80° turns using the CD-2 are illustrated in Figures 3-8, 3-9, 3-10, and 3-11.

Back-course approaches may also be made with the course director. The course director resolves all ambiguities. When the monitor switch is pressed, the course director indicates, without ambiguity, where the track lies; that is, either to the left or right of the aircraft position. Normal sensing of the deviation indicator (cross-pointer meter) is provided under all operating conditions. It is only necessary to remember whether the desired direction of flight places the blue sector on the right (front course) or on the left (back course), and to set the function switch accordingly.

ILS Procedure. To use the course director during front-course ILS approaches, proceed as follows:

Step 1. Prepare the course director for operation (paragraph 3-3). Set the S-10 or IN-14 pointer to the published inbound track with the blue sector on the right (front course).

Step 2. Set the S-10 to LOC BLUE RIGHT, or the C-60 to CD LOC BLUE RIGHT.

Step 3. Steer toward the needle until the needle centers. Keep the needle centered to intercept and maintain the desired track.

3-7. HOLDING PROCEDURES.

Holding procedures using the course director with VOR or localizer signals are illustrated and described in Figure 3-12.

3-8. LF RANGE FLYING.

The course director may be used for low-frequency range flying when close conformance to headings is required. Range legs and let-downs may be flown with visual aid from the course director by using the MAG HDG feature. To do so, set-in the published heading of the leg and maintain the heading by keeping the vertical needle centered. If crosswinds cause the aircraft to drift, set-in correction "into the wind" as required to compensate for the drift. It will be necessary to determine aurally whether the airplane is remaining "on the beam" when using this procedure. The MAG HDG feature may be used in the same manner for all ADF en route or let-down procedures.

3-9. POSITION DETERMINATION.

Any standard positioning procedure may be completed using the MAG HDG feature of the course director to keep the aircraft on a desired heading.

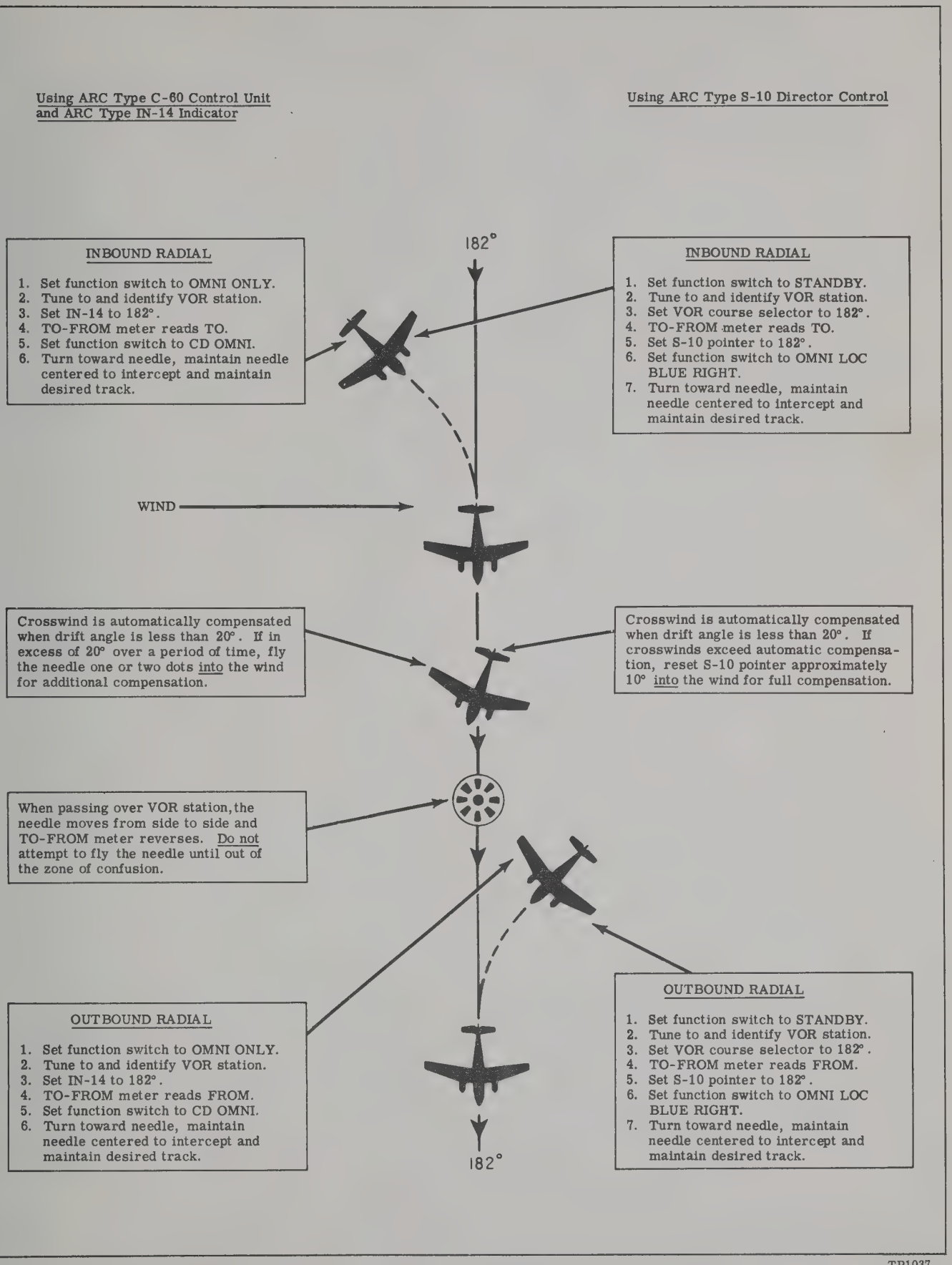
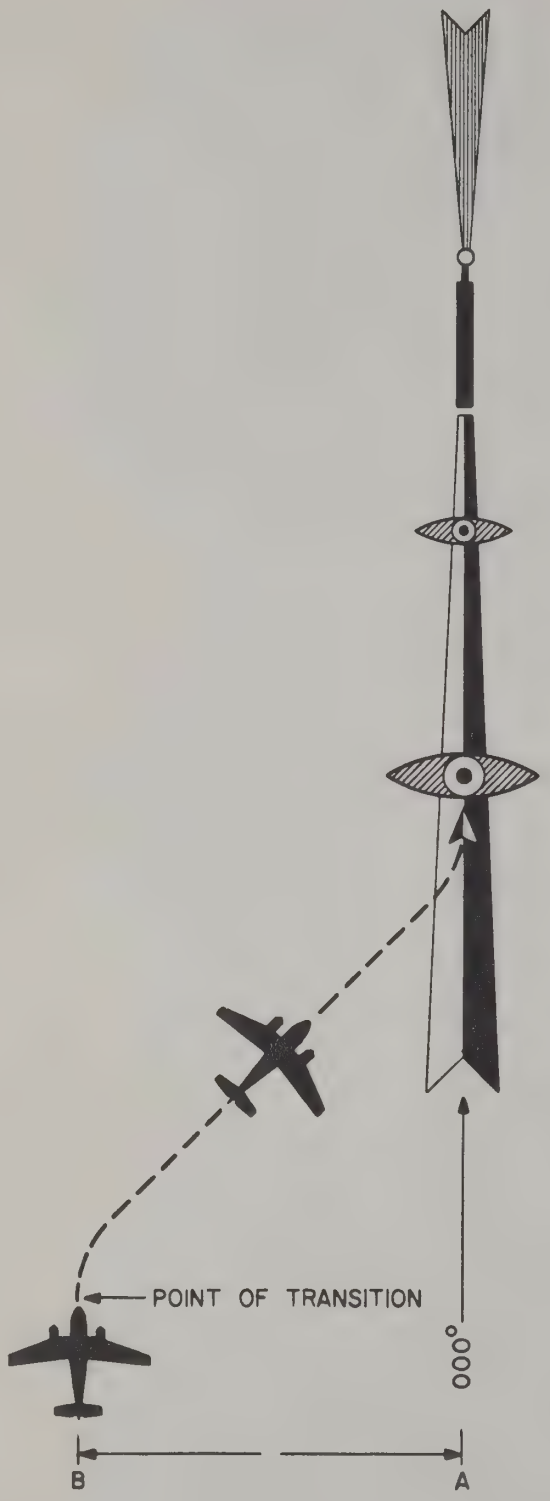

Using ARC Type C-60 Control Unit and ARC Type IN-14 Indicator
Using ARC Type S-10 Director Control
INBOUND RADIAL
1. Set function switch to OMNI ONLY.
2. Tune to and identify VOR station.
3. Set IN-14 to 182°.
4. TO-FROM meter reads TO.
5. Set function switch to CD OMNI.
6. Turn toward needle, maintain needle centered to intercept and maintain desired track.
182°
INBOUND RADIAL
1. Set function switch to STANDBY.
2. Tune to and identify VOR station.
3. Set VOR course selector to 182°.
4. TO-FROM meter reads TO.
5. Set S-10 pointer to 182°.
6. Set function switch to OMNI LOC BLUE RIGHT.
7. Turn toward needle, maintain needle centered to intercept and maintain desired track.
WIND
Crosswind is automatically compensated when drift angle is less than 20°. If in excess of 20° over a period of time, fly the needle one or two dots into the wind for additional compensation.
Crosswind is automatically compensated when drift angle is less than 20°. If crosswinds exceed automatic compensation, reset S-10 pointer approximately 10° into the wind for full compensation.
When passing over VOR station, the needle moves from side to side and TO-FROM meter reverses. Do not attempt to fly the needle until out of the zone of confusion.
OUTBOUND RADIAL
1. Set function switch to OMNI ONLY.
2. Tune to and identify VOR station.
3. Set IN-14 to 182°.
4. TO-FROM meter reads FROM.
5. Set function switch to CD OMNI.
6. Turn toward needle, maintain needle centered to intercept and maintain desired track.
OUTBOUND RADIAL
1. Set function switch to STANDBY.
2. Tune to and identify VOR station.
3. Set VOR course selector to 182°.
4. TO-FROM meter reads FROM.
5. Set S-10 pointer to 182°.
6. Set function switch to OMNI LOC BLUE RIGHT.
7. Turn toward needle, maintain needle centered to intercept and maintain desired track.
182°
TP1037

Figure 3-5. VOR Navigation with ARC Type CD-2 Course Director



PROCEDURE:

If aircraft position is such that interception of localizer track can be made prior to arrival at outer marker (see note 4), proceed as follows:

1. Tune in localizer. Identify.
2. Set IN-14 to 000°.
3. Set C-60 to CD LOC BLUE RIGHT.
4. Steer to keep needle centered; intercept and follow front-course approach.
5. If crosswinds exceed automatic compensation, set IN-14 pointer approximately 10° into the wind for full compensation.

CAUTION

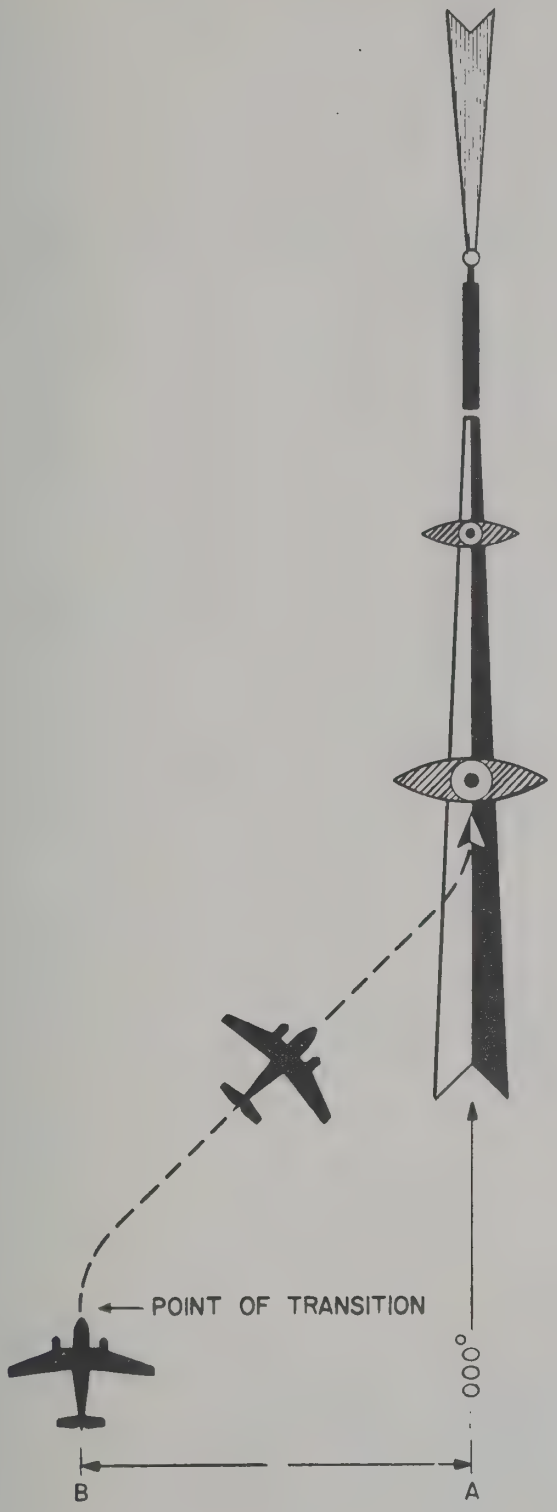
Set in only the published bearing of the front-course or No. 1 approach on the IN-14.

Notes:

1. All localizer beams have nulls in an area extending approximately 2 miles from the localizer shack at altitudes above normal approach height. Do not attempt to fly precise tracks in these areas.
2. The CD-2 needs only the information published for front-course approach to accomplish either front-course or back-course procedures.
3. Back-course approaches may be accomplished in the same manner, except that direction of final approach will be CD LOC BLUE LEFT.
4. Distance from A to B can be approximately 75 per cent of distance from A to outer marker, at 120 mph (or less) approach speeds.

TP1499

Figure 3-6. Typical ILS Approach Using C-60 and IN-14



PROCEDURE:

If aircraft position is such that interception of localizer track can be made prior to arrival at outer marker (see note 4), proceed as follows:

1. Tune in localizer. Identify.
2. Set S-10 to 000°.
3. Set S-10 to OMNI LOC BLUE RIGHT.
4. Steer to keep needle centered; intercept and follow front-course approach.
5. If crosswinds exceed automatic compensation, set S-10 pointer approximately 10° into the wind for full compensation.

CAUTION

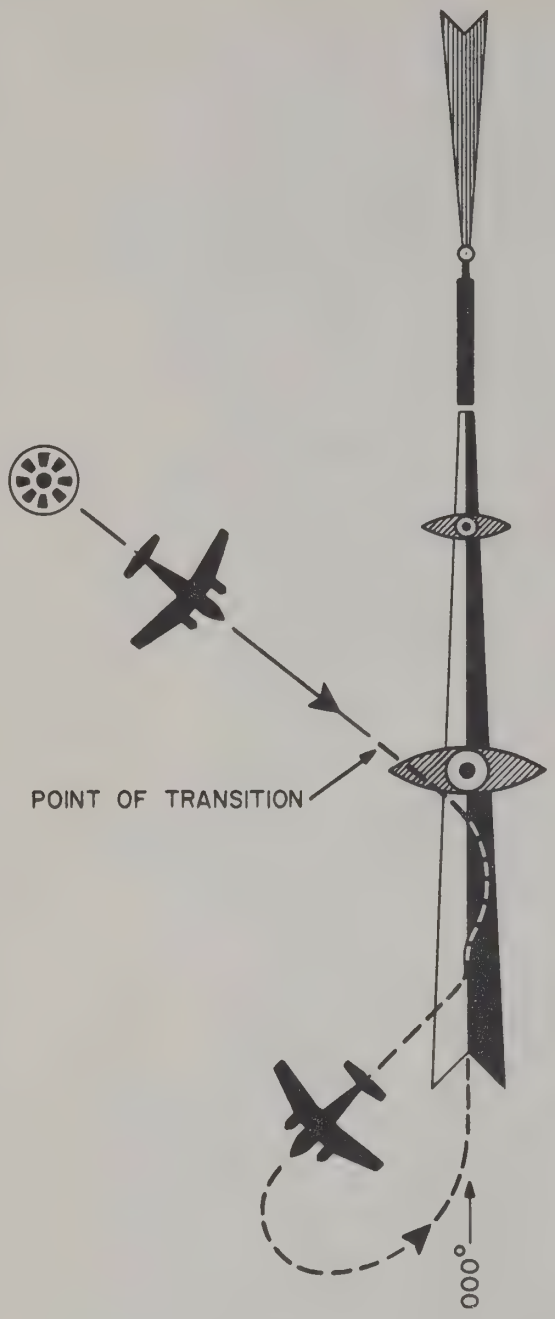
Set in only the published bearing of the front-course or No. 1 approach on the S-10.

Notes:

1. All localizer beams have nulls in an area extending approximately 2 miles from the localizer shack at altitudes above normal approach height. Do not attempt to fly precise tracks in these areas.
2. The CD-2 needs only the information published for front-course approach to accomplish either front-course or back-course procedures.
3. Back-course approaches may be accomplished in the same manner, except that direction of final approach will be LOC BLUE LEFT.
4. Distance from A to B can be approximately 75 per cent of distance from A to outer marker, at 120 mph (or less) approach speeds.

TP1501

Figure 3-7. Typical ILS Approach Using S-10



PROCEDURE:

1. Track out from VOR or by ADF to vicinity of outer compass locator.
2. Tune in and identify localizer as soon as possible after leaving VOR.
3. Set C-60 to LOC ONLY. Set IN-14 to 000°.
4. Fly VOR track or ADF until cross pointer vertical needle just leaves pin.
5. Set C-60 to CD LOC BLUE LEFT and steer to center needle.
6. After back-course track is intercepted, turn 45° off track (as shown on approach chart) to procedure turn.
7. When over halfway through turn, switch C-60 to CD LOC BLUE RIGHT.
8. Steer to center needle; intercept and follow front-course approach.

CAUTION

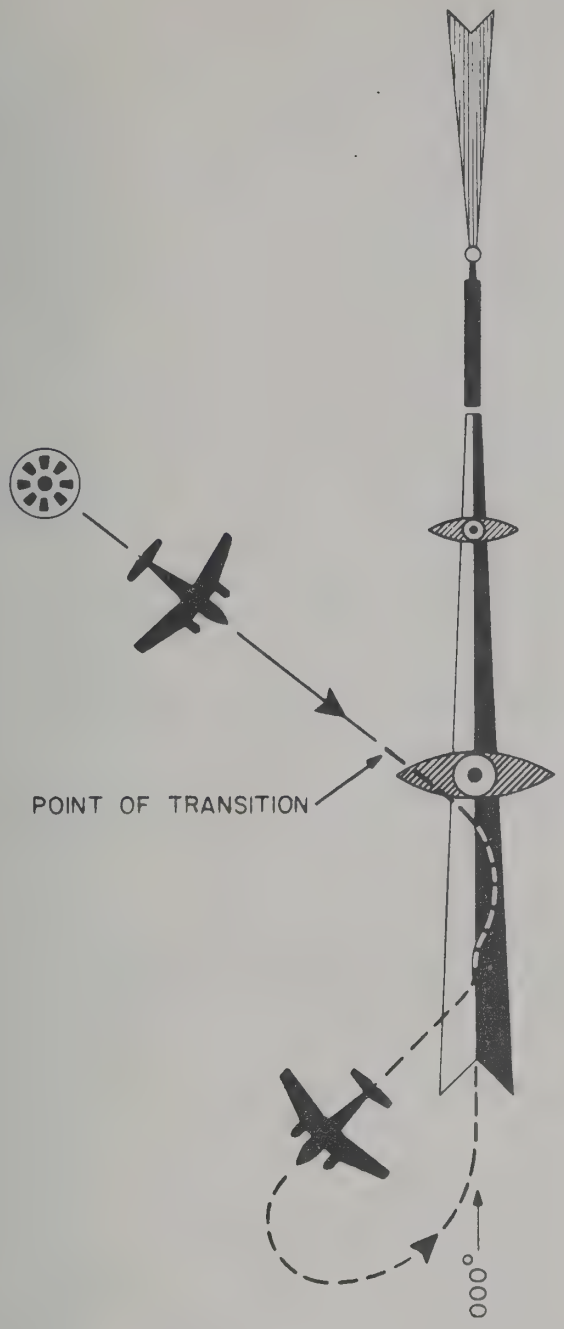
Set in only the published bearing of the front-course or No. 1 approach on the IN-14.

Notes:

1. All localizer beams have nulls in an area extending approximately 2 miles from the localizer shack at altitudes above normal approach height. Do not attempt to fly precise tracks in these areas.
2. The CD-2 needs only the information published for front-course approach to accomplish either front-course or back-course procedures.
3. Back-course approaches may be accomplished in the same manner, except that direction of final approach will be CD LOC BLUE LEFT.

TP1503

Figure 3-8. Typical ILS Approach Using C-60, IN-14, and VOR or ADF with 45-Degree Procedure Turn



PROCEDURE:

1. Track out from VOR or by ADF to vicinity of outer compass locator.
2. Tune in and identify localizer as soon as possible after leaving VOR with receiver set for localizer operation.
3. Set S-10 function switch to STANDBY and pointer to 000°.
4. Fly VOR track or ADF until cross pointer vertical needle just leaves pin.
5. Set S-10 to LOC BLUE LEFT and steer to center needle.
6. After back-course track is intercepted, turn 45° off track (as shown on approach chart) to procedure turn.
7. When over halfway through turn, switch S-10 to OMNI LOC BLUE RIGHT.
8. Steer to center needle; intercept and follow front-course approach.

CAUTION

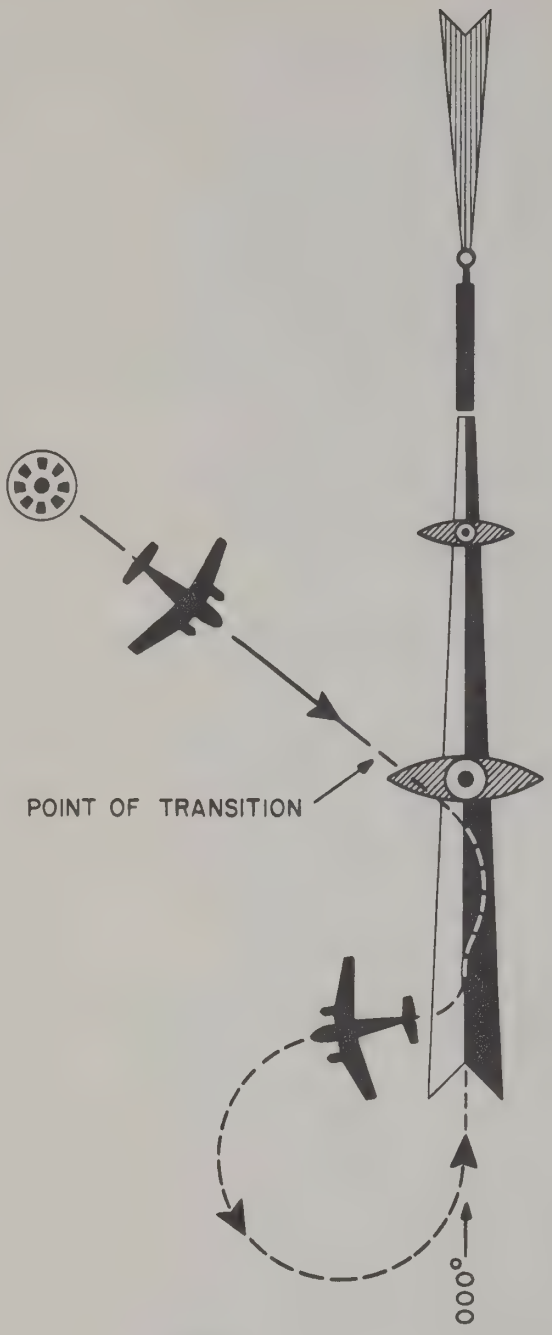
Set in only the published bearing of the front-course or No. 1 approach on the S-10.

Notes:

1. All localizer beams have nulls in an area extending approximately 2 miles from the localizer shack at altitudes above normal approach height. Do not attempt to fly precise tracks in these areas.
2. The CD-2 needs only the information published for front-course approach to accomplish either front-course or back-course procedures.
3. Back-course approaches may be accomplished in the same manner except that direction of final approach will be LOC BLUE LEFT.

TP1505

Figure 3-9. Typical ILS Approach Using S-10 and VOR or ADF with 45-Degree Procedure Turn



PROCEDURE:

1. Track out from VOR or by ADF to vicinity of outer compass locator.
2. Tune in and identify localizer as soon as possible after leaving VOR.
3. Set C-60 to LOC ONLY. Set IN-14 to 000°.
4. Fly VOR track or ADF until cross pointer vertical needle just leaves pin.
5. Set C-60 to CD LOC BLUE LEFT and steer to center needle.
6. After back-course track is intercepted, turn 80° off track (as shown on approach chart) to procedure turn.
7. When over halfway through turn, switch C-60 to CD LOC BLUE RIGHT.
8. Steer to center needle; intercept and follow front-course approach.

CAUTION

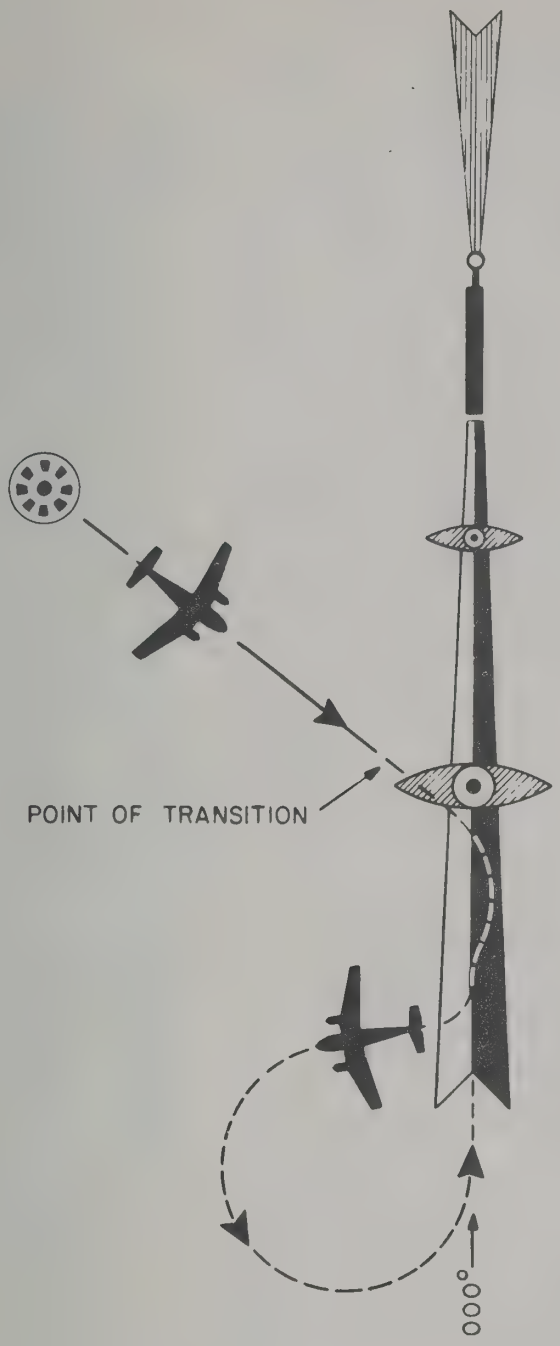
Set in only the published bearing of the front-course or No. 1 approach on the IN-14.

Notes:

1. All localizer beams have nulls in an area extending approximately 2 miles from the localizer shack at altitudes above normal approach height. Do not attempt to fly precise tracks in these areas.
2. The CD-2 needs only the information published for front-course approach to accomplish either front-course or back-course procedures.
3. Back-course approaches may be accomplished in the same manner except that direction of final approach will be CD LOC BLUE LEFT.

TP1507

Figure 3-10. Typical ILS Approach Using C-60, IN-14, and VOR or ADF with 80-Degree Procedure Turn



PROCEDURE:

1. Track out from VOR or by ADF to vicinity of outer compass locator.
2. Tune in and identify localizer as soon as possible after leaving VOR with receiver set for localizer operation.
3. Set S-10 function switch to STANDBY and pointer to 000°.
4. Fly VOR track or ADF until cross pointer vertical needle just leaves pin.
5. Set S-10 to LOC BLUE LEFT and steer to center needle.
6. After back-course track is intercepted, turn 80° off track (as shown on approach chart) to procedure turn.
7. When over halfway through turn, switch S-10 to OMNI LOC BLUE RIGHT.
8. Steer to center needle; intercept and follow front-course approach.

CAUTION

Set in only the published bearing of the front-course or No. 1 approach on the S-10.

Notes:

1. All localizer beams have nulls in an area extending approximately 2 miles from the localizer shack at altitudes above normal approach height. Do not attempt to fly precise tracks in these areas.
2. The CD-2 needs only the information published for front-course approach to accomplish either front-course or back-course procedures.
3. Back-course approaches may be accomplished in the same manner except that direction of final approach will be LOC BLUE LEFT.

TP1509

Figure 3-11. Typical ILS Approach Using S-10 and VOR or ADF with 80-Degree Procedure Turn

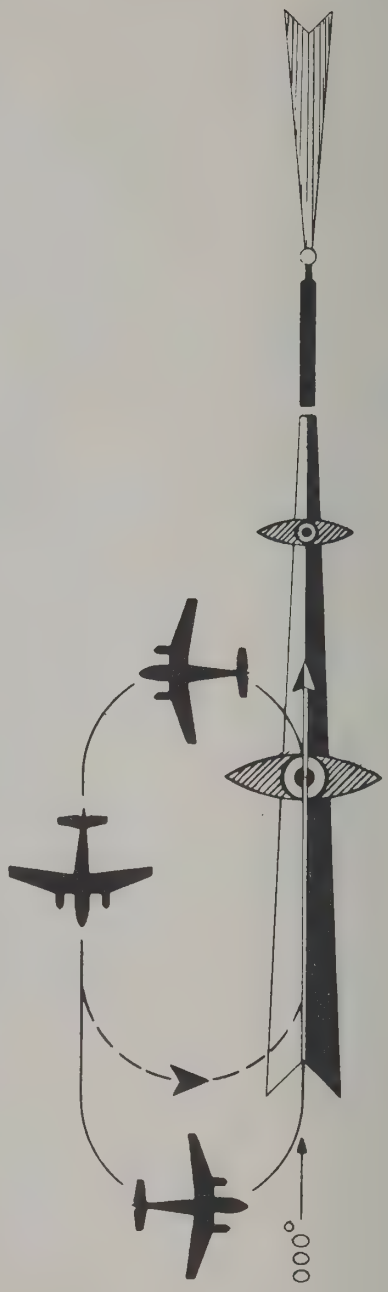
HOLDING AT COMPASS LOCATOR ON ILS

Assuming that Receiver is tuned to facility being used, and that S-10 or IN-14 has been set for front-course approach, proceed as follows:

1. At LOM start right or left turn as directed.
2. Set C-60 or S-10 function switch to MAG HDG and continue turn until needle centers.
3. Keeping needle centered, fly out the desired time; i.e., 1 minute, 2 minutes, etc. Following this procedure, the needle will read backward since the S-10 or IN-14 pointer is set to 000°. If normal sensing is desired, set the S-10 or IN-14 pointer to 180° for outbound leg of holding pattern.
4. At expiration of time, start turn back toward ILS track.
5. After turn is started, set C-60 function switch to CD LOC BLUE RIGHT or S-10 function switch to OMNI LOC BLUE RIGHT.
6. Keep needle centered to reintercept track.

HOLDING AT COMPASS LOCATOR ON VOR

Holding procedures using a VOR radial are accomplished in a similar manner as for ILS, except that C-60 function switch is set to CD OMNI or S-10 function switch is set to OMNI LOC BLUE RIGHT.



NOTE:
REINTERCEPTION OF TRACK MAY BE ACCOMPLISHED AT ANY TIME DURING HOLDING PATTERN BY EXECUTING STEPS 4 THROUGH 6, AS REQUIRED.

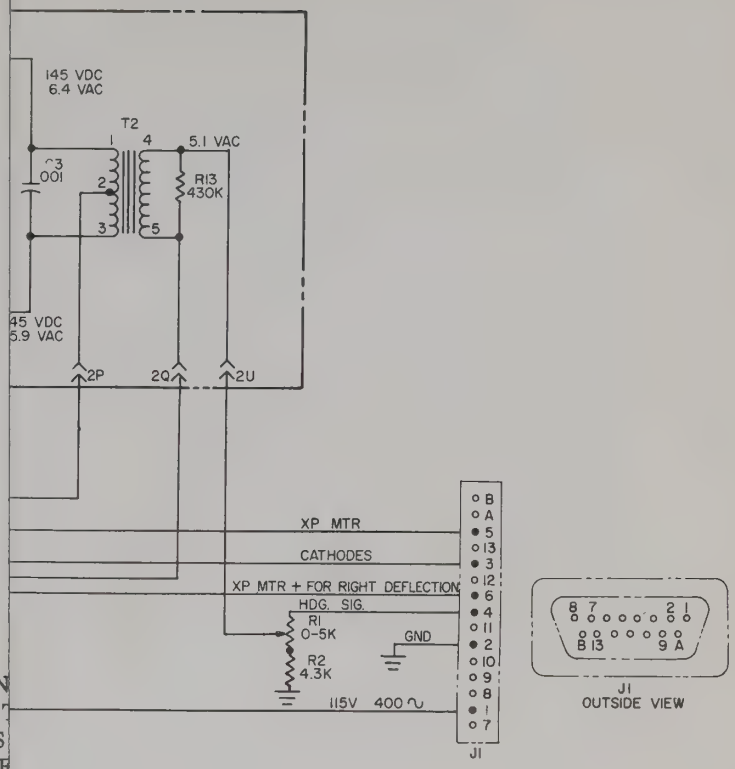
TP1041

Figure 3-12. Typical Holding Procedures with ARC Type CD-2 Course Director

SECTION IV

MAINTENANCE

No special preventive maintenance procedures are required for the units of the ARC Type CD-2 Course Director. In case of trouble, maintenance (including alignment and adjustments within the CA-11A Computer Amplifier) should be undertaken only by a qualified service technician. Figures 4-1, 4-2, 4-3, and 4-4 are schematic diagrams of the CA-11A, the IN-14, the C-60, and the S-10, respectively.



NOTES:

1. CONNECTIONS BETWEEN PLUG-IN
BY MEANS OF TERMINAL BOARD
IDENTIFICATION OF MATING PINS
FOLLOWS A COMBINATION NUMBE
CODE INDICATING POSITION ON BO

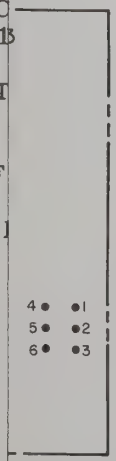
2. ALL CAPACITANCE VALUES ARE I
FARADS (μF) UNLESS OTHERWISE

3. ALL RESISTANCE VALUES ARE IN
PLIER K=1,000; MEG=1,000,000.

4. D-C VOLTAGE VALUES ARE APPR
ARE BASED ON THE FOLLOWING C
   (A) NEGATIVE TERMINAL OF V
   GROUNDED TO THE CHASSI
   (B) VOLTAGE INPUT SET FOR 1
   400∼
   (C) MEASUREMENTS MADE WIT
   (D) NO HEADING SIGNAL INPUT

5. A-C VOLTAGE VALUES ARE APPR
ARE BASED ON THE FOLLOWING C
   (A) VOLTAGE INPUT SET FOR 1
   400∼.
   (B) MEASUREMENTS MADE WIT
   ARE VOLTAGE TO CHASSIS
   WHERE NOTED.
   (C) HEADING SIGNAL INPUT OF

6. THIS VOLTAGE IS ±1.8 VDC FOR H
SIGNAL INPUT OF 18°.



21802B

Figure 4-1. ARC Type CA-11A Computer Amplifier, Schematic Diagram

NOTES:

1. CONNECTIONS BETWEEN PLUG-IN MODULES ARE BY MEANS OF TERMINAL BOARD TB1. TERMINAL IDENTIFICATION OF MATING PINS AND JACKS FOLLOWS A COMBINATION NUMBER AND LETTER CODE INDICATING POSITION ON BOARDS.

2. ALL CAPACITANCE VALUES ARE IN MICRO-FARADS (μF) UNLESS OTHERWISE SPECIFIED.

3. ALL RESISTANCE VALUES ARE IN OHMS. MULTIPLIER K=1,000; MEG=1,000,000.

4. D-C VOLTAGE VALUES ARE APPROXIMATE AND ARE BASED ON THE FOLLOWING CONDITIONS.
   (A) NEGATIVE TERMINAL OF VOLTMETER GROUNDED TO THE CHASSIS.
   (B) VOLTAGE INPUT SET FOR 115 VOLTS 400~
   (C) MEASUREMENTS MADE WITH VTVM,
   (D) NO HEADING SIGNAL INPUT.

5. A-C VOLTAGE VALUES ARE APPROXIMATE AND ARE BASED ON THE FOLLOWING CONDITIONS.
   (A) VOLTAGE INPUT SET FOR 115 VOLTS 400~.
   (B) MEASUREMENTS MADE WITH VTVM AND ARE VOLTAGE TO CHASSIS EXCEPT WHERE NOTED.
   (C) HEADING SIGNAL INPUT OF 18°.

6. THIS VOLTAGE IS ±1.8 VDC FOR HEADING SIGNAL INPUT OF 18°.

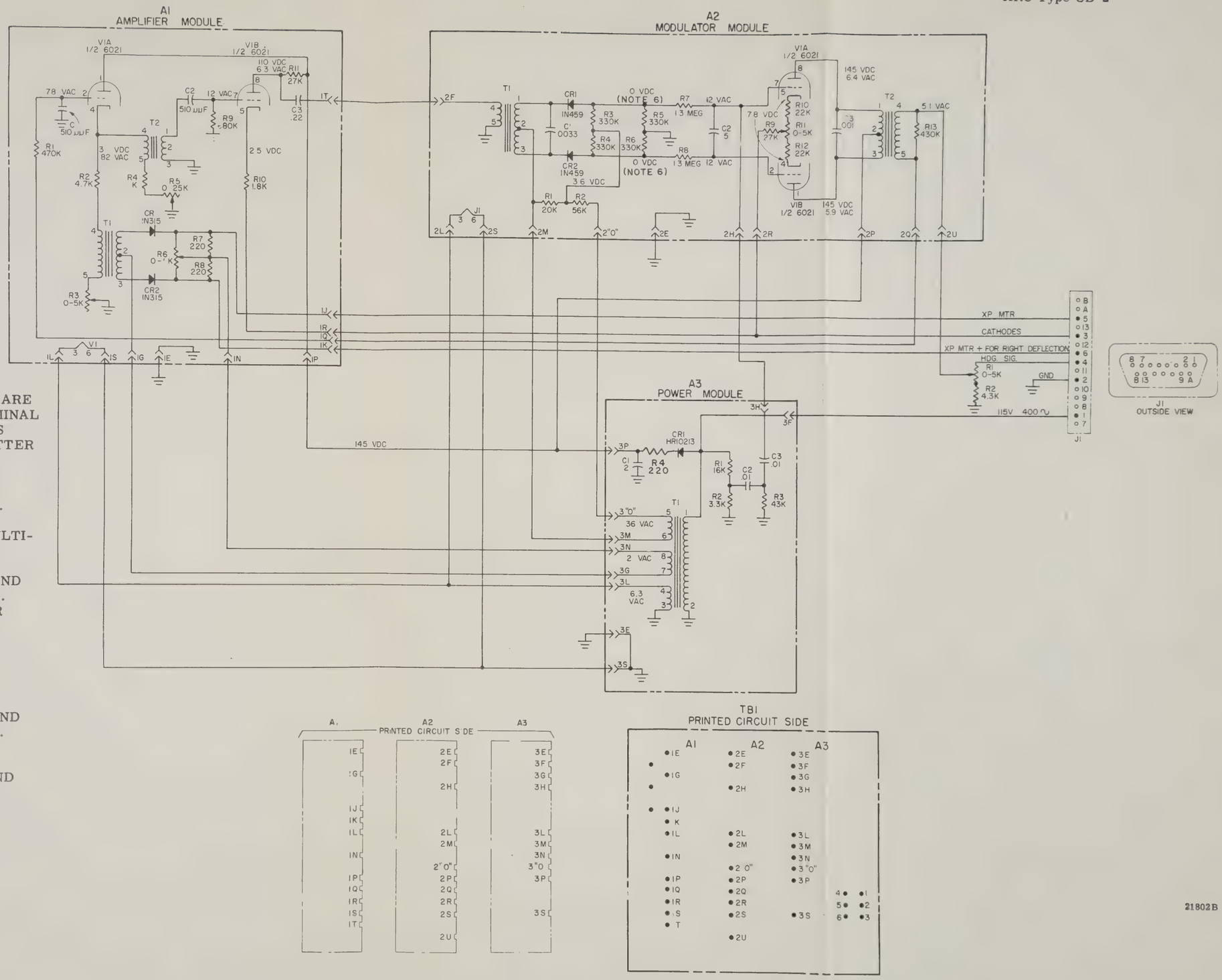
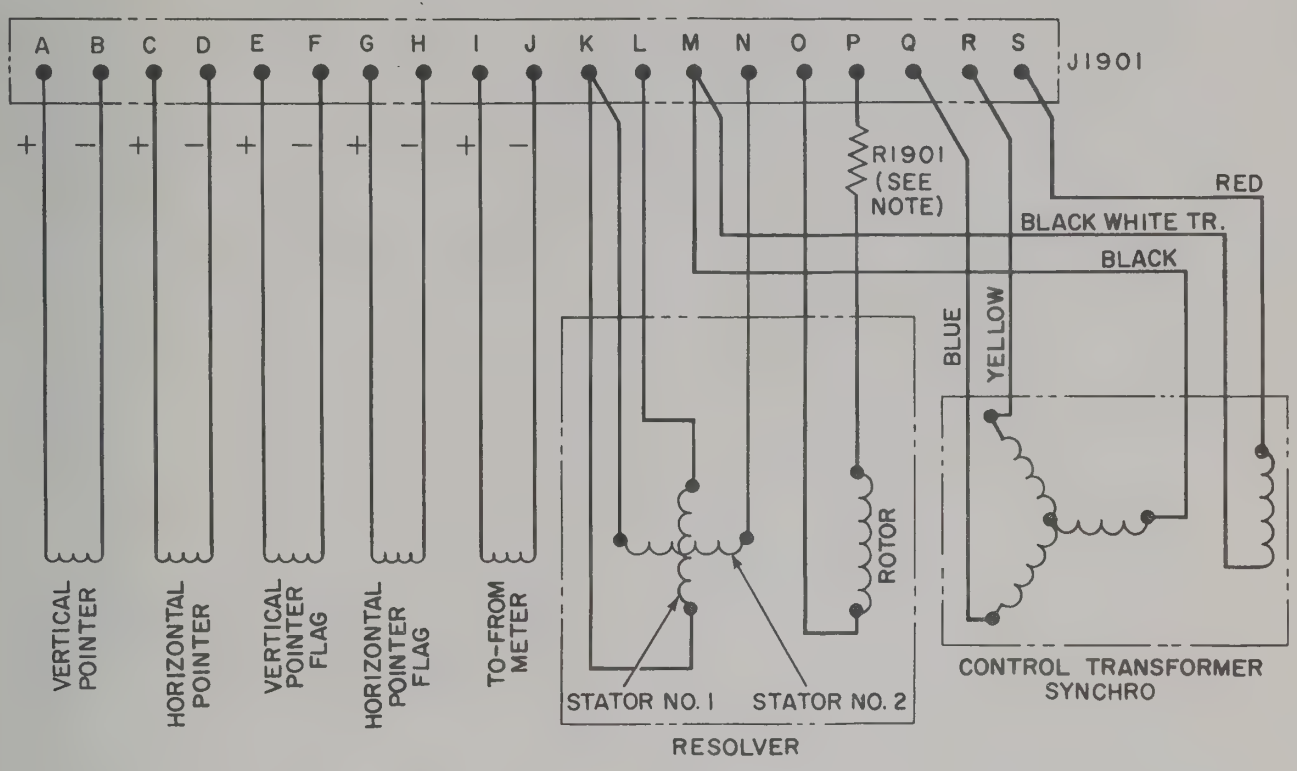


Figure 4-1. ARC Type CA-11A Computer Amplifier, Schematic Diagram



MECHANISM	RECEPTACLE PINS +	RECEPTACLE PINS -	DEFLECTION	SENSITIVITY (MICROAMPERES)	RESISTANCE (OHMS)
VERTICAL POINTER	A	B	RIGHT	150-0-150 ±7.5	1000 ±30
HORIZONTAL POINTER	C	D	DOWN	150-0-150 ±7.5	1000 ±30
VERTICAL POINTER FLAG	E	F	DOWN	125 ±6.25 SUPPRESSED 250 ±12.5 CONCEALED	1000 ±30
HORIZONTAL POINTER FLAG	G	H	RIGHT	125 ±6.25 SUPPRESSED 250 ±12.5 CONCEALED	1000 ±30
TO-FROM METER	I	J	TO	90-0-90 ±15	335 ±67

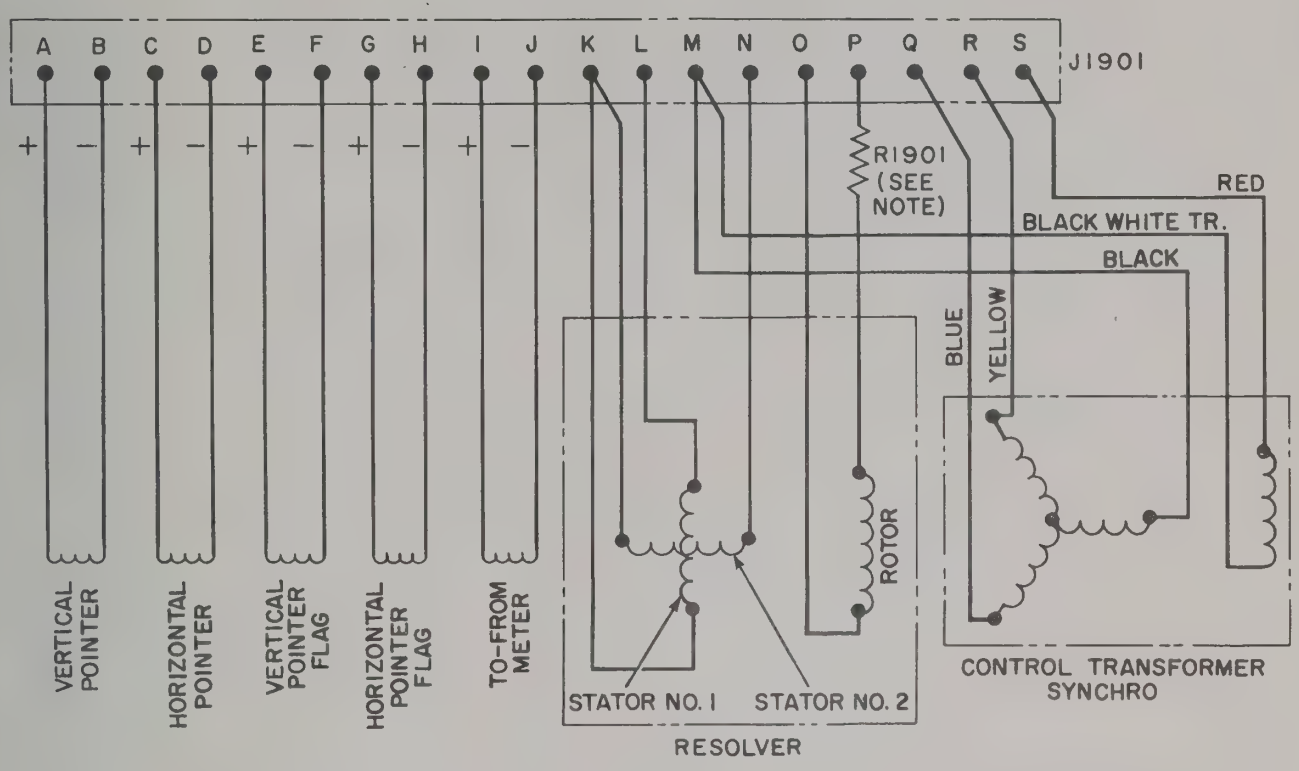
RESOLVER	RECEPTACLE PINS		RESISTANCE (OHMS)
STATOR NO. 1	GREEN YELLOW	K L	1040 ±125
STATOR NO. 2	GRAY BLACK	K N	1040 ±125
ROTOR CIRCUIT	RED WHITE	O P	2350-3200

NOTE:

VALUE DETERMINED AT TIME OF ASSEMBLY

18028F

Figure 4-2. ARC Type IN-14 Course Indicator, Schematic Diagram



MECHANISM	RECEPTACLE PINS +	RECEPTACLE PINS -	DEFLECTION	SENSITIVITY (MICROAMPERES)	RESISTANCE (OHMS)
VERTICAL POINTER	A	B	RIGHT	150-0-150 ±7.5	1000 ±30
HORIZONTAL POINTER	C	D	DOWN	150-0-150 ±7.5	1000 ±30
VERTICAL POINTER FLAG	E	F	DOWN	125 ±6.25 SUPPRESSED 250 ±12.5 CONCEALED	1000 ±30
HORIZONTAL POINTER FLAG	G	H	RIGHT	125 ±6.25 SUPPRESSED 250 ±12.5 CONCEALED	1000 ±30
TO-FROM METER	I	J	TO	90-0-90 ±15	335 ±67

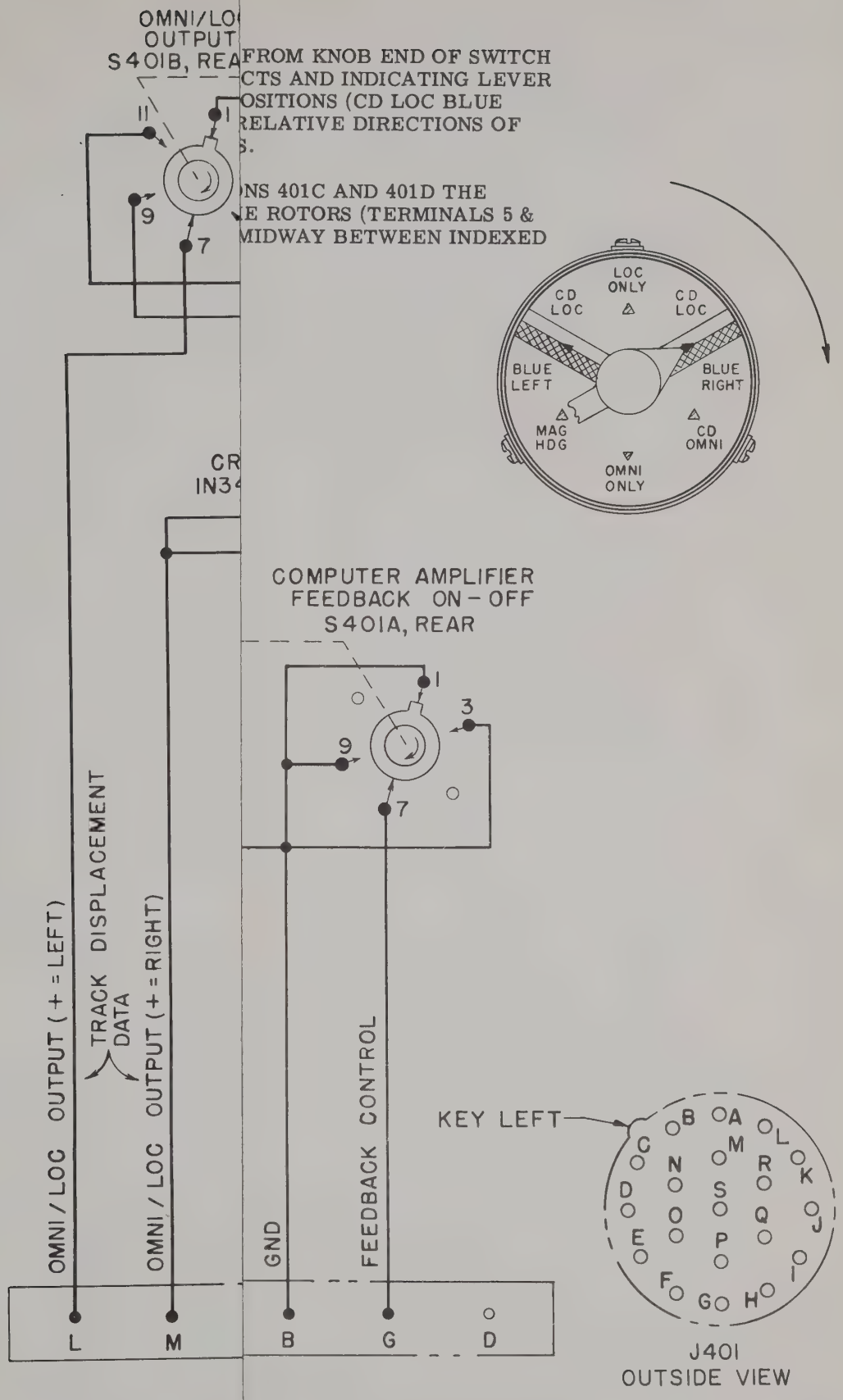
RESOLVER	RECEPTACLE PINS		RESISTANCE (OHMS)
STATOR NO. 1	GREEN YELLOW	K L	1040 ±125
STATOR NO. 2	GRAY BLACK	K N	1040 ±125
ROTOR CIRCUIT	RED WHITE	O P	2350-3200

NOTE:

VALUE DETERMINED AT TIME OF ASSEMBLY

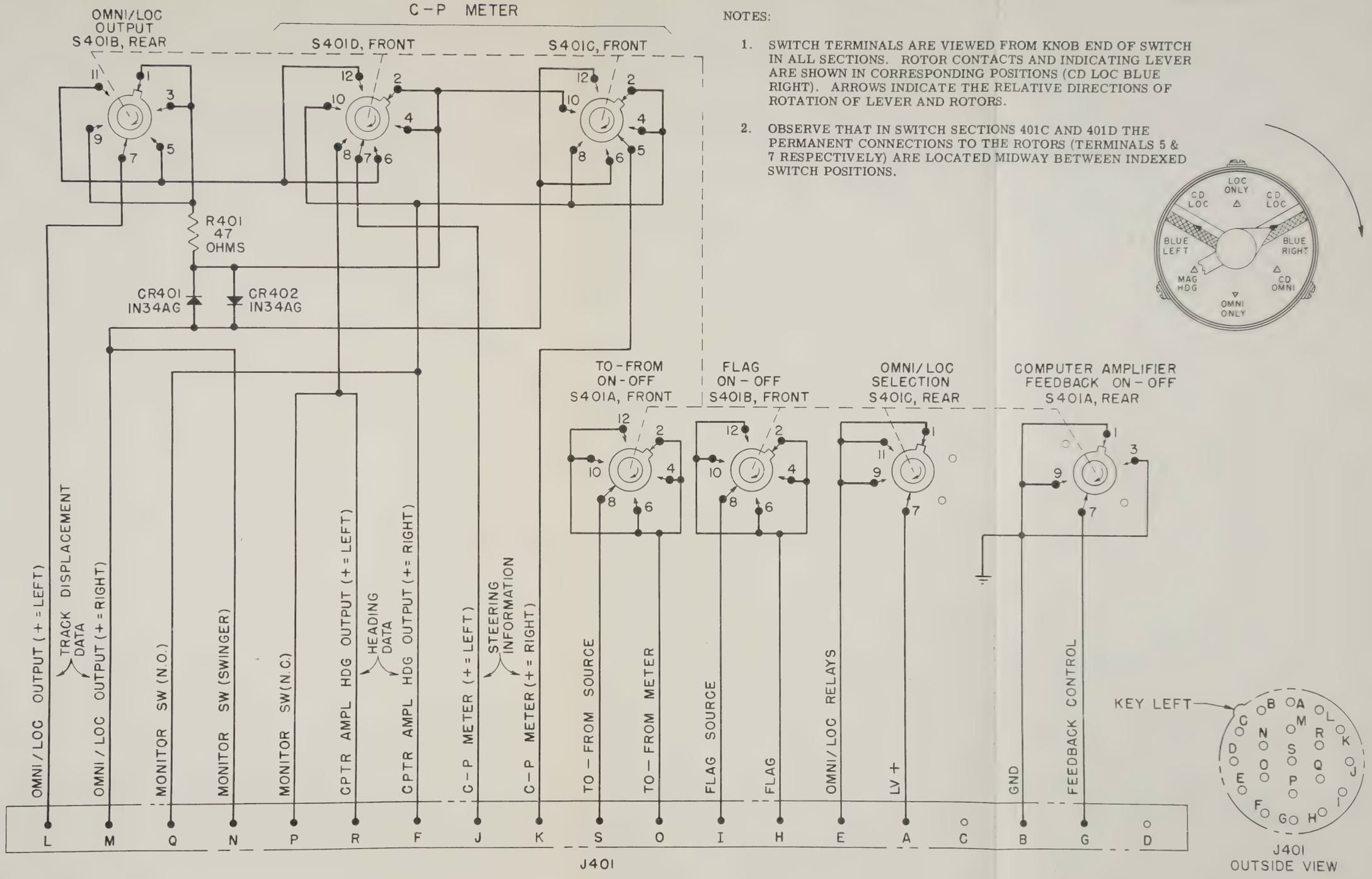
18028F

Figure 4-2. ARC Type IN-14 Course Indicator, Schematic Diagram



18332B

Figure 4-3. ARC Type C-60 Control Unit, Schematic Diagram

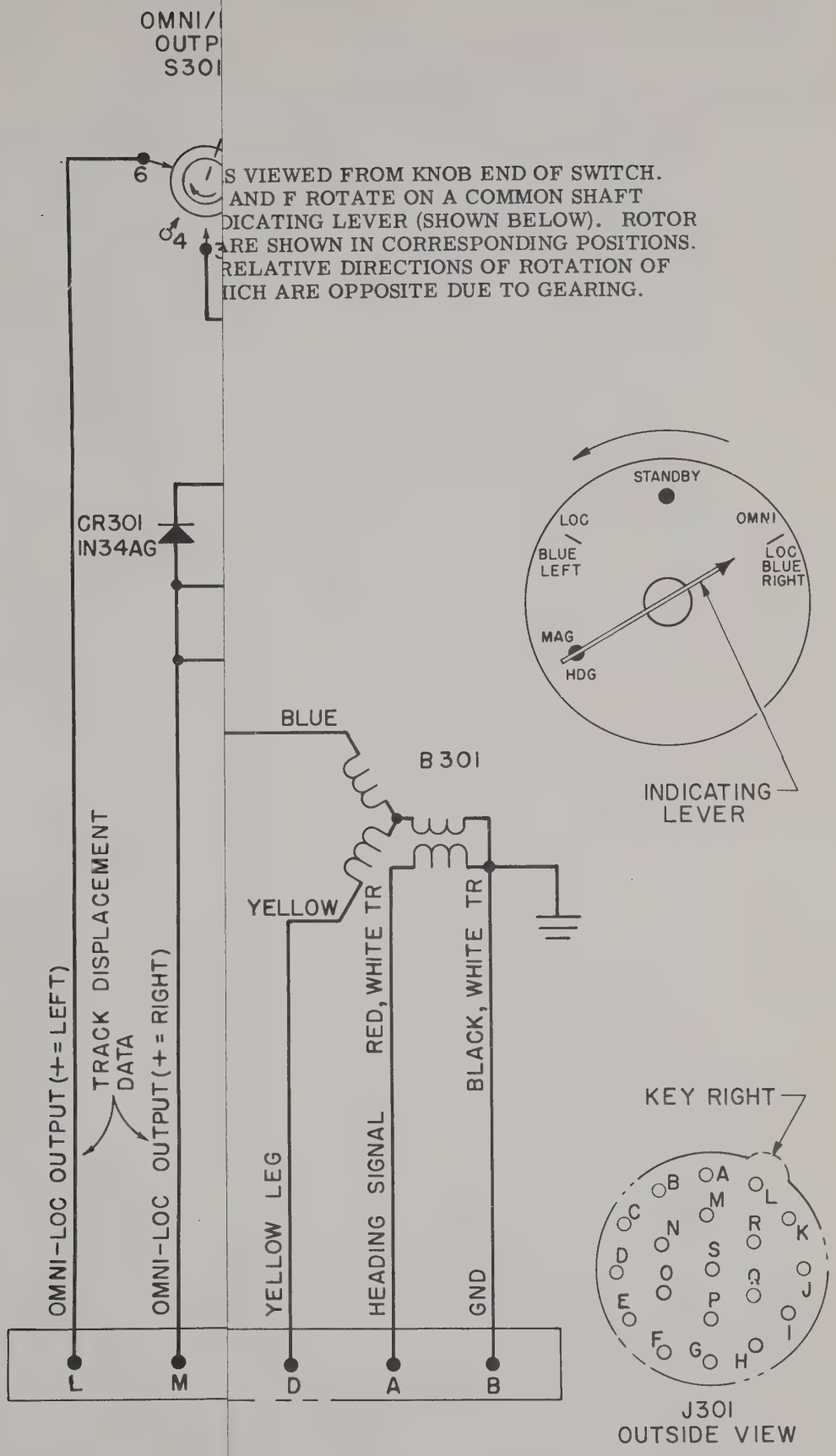


NOTES:

1. SWITCH TERMINALS ARE VIEWED FROM KNOB END OF SWITCH IN ALL SECTIONS. ROTOR CONTACTS AND INDICATING LEVER ARE SHOWN IN CORRESPONDING POSITIONS (CD LOC BLUE RIGHT). ARROWS INDICATE THE RELATIVE DIRECTIONS OF ROTATION OF LEVER AND ROTORS.
2. OBSERVE THAT IN SWITCH SECTIONS 401C AND 401D THE PERMANENT CONNECTIONS TO THE ROTORS (TERMINALS 5 & 7 RESPECTIVELY) ARE LOCATED MIDWAY BETWEEN INDEXED SWITCH POSITIONS.

18332B

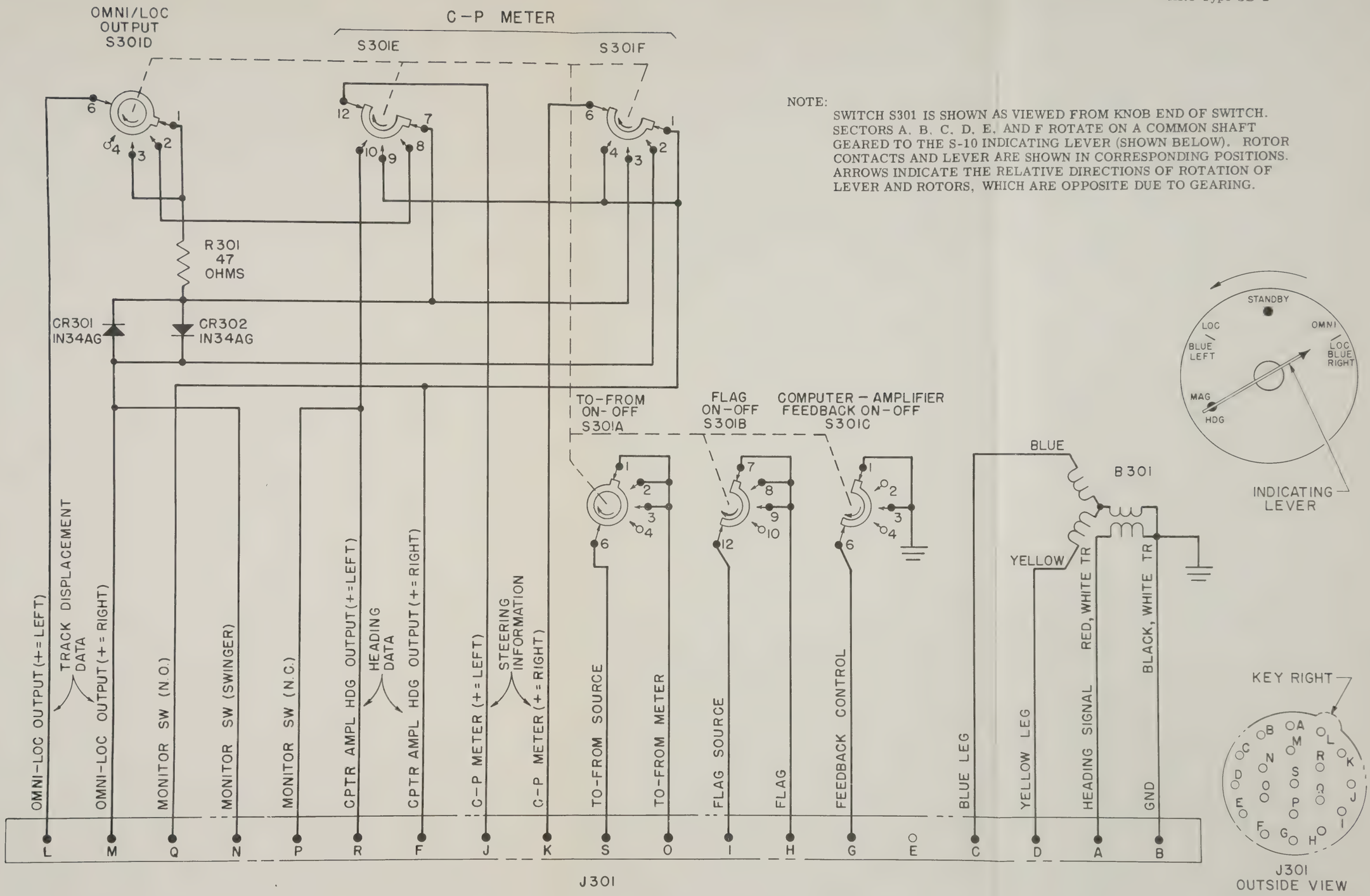
Figure 4-3. ARC Type C-60 Control Unit, Schematic Diagram



20047E

Figure 4-4. ARC Type S-10 Director Control, Schematic Diagram

NOTE:
SWITCH S301 IS SHOWN AS VIEWED FROM KNOB END OF SWITCH. SECTORS A, B, C, D, E, AND F ROTATE ON A COMMON SHAFT GEARED TO THE S-10 INDICATING LEVER (SHOWN BELOW). ROTOR CONTACTS AND LEVER ARE SHOWN IN CORRESPONDING POSITIONS. ARROWS INDICATE THE RELATIVE DIRECTIONS OF ROTATION OF LEVER AND ROTORS, WHICH ARE OPPOSITE DUE TO GEARING.



20047E

Figure 4-4. ARC Type S-10 Director Control, Schematic Diagram

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